

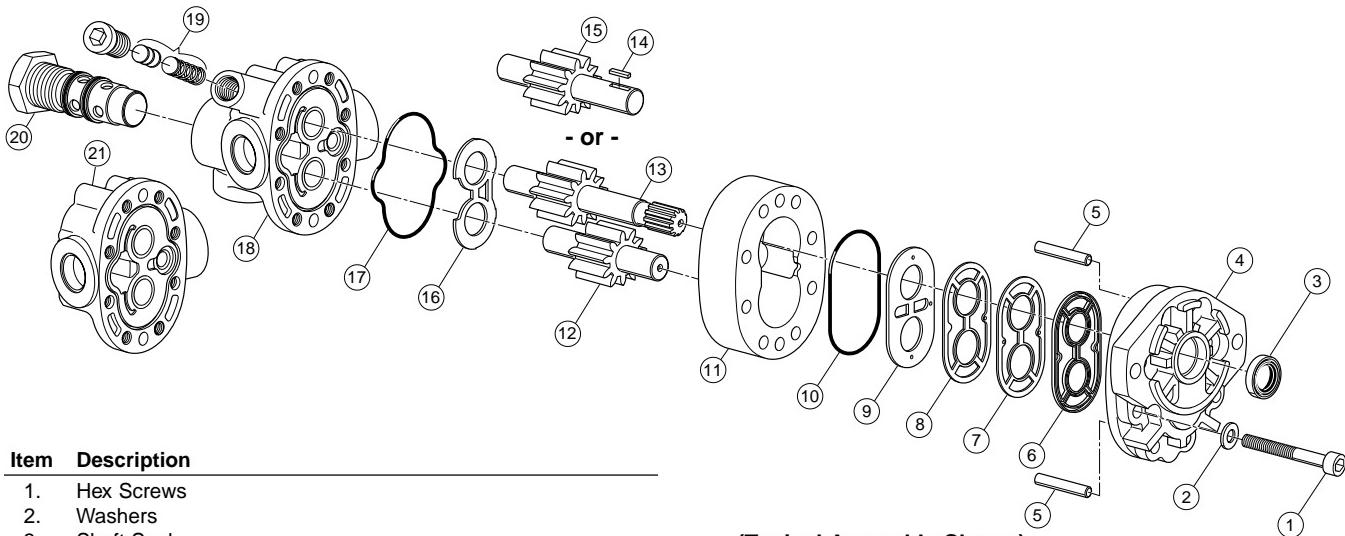


Bulletin 2630-C1

Series D/H/M Fixed Displacement Gear Pumps Service Manual

Effective: January, 2000
Supersedes: December, 1988



**Item Description**

1. Hex Screws
2. Washers
3. Shaft Seal
4. Front Cover
5. Dowel Pin
6. V-Seal
7. Gasket
8. Heat Shield
9. Wear Plate
10. O-Ring
11. Center Section
12. Driven Gear Assembly
13. Drive Gear Assembly (Splined)
14. Key
15. Drive Gear Assembly (Keyed)
16. Thrust Plate ("H" & "M" Only)
17. Molded O-Ring
18. Back Cover ("H" Flow Divider Pump Only)
19. Relief Valve ("H" Flow Divider Pump Only)
20. Flow Control ("H" Flow Divider Pump Only)
21. Back Cover

Repair Kits

Series	Part Number	Consisting of Items
"D"	686632K 745083K (Viton Seals)	3, 6, 7, 8, 9, 10, 17
"H"	706024K 745100K (Viton Seals)	3, 6, 7, 8, 9, 10, 16, 17
"H" Flow Divider	696173K	3, 6, 7, 8, 9, 10, 16, 17 Seals only. For 19 & 20
"H" Power Steering	805333K	3, 6, 7, 8, 9, 10, 16, 17 Seals only. For 19 & 20
"M"	715567K 745088K (Viton Seals)	3, 6, 7, 8, 9, 10, 16, 17

Trouble Shooting Guide

Before the pump is removed or disassembled, check the following list of common troubles and remedies. It could save time effort, and money.

Trouble	Probable Cause	Remedy
1. Noisy Pump	a. Low oil supply b. Oil too heavy (i.e. viscous) c. Air leak in inlet line d. Partly blocked inlet line	a. Fill reservoir b. Change to proper viscosity c. Check plumbing d. Check for foreign object and/or clean
2. Foaming Oil	a. Pump cavitating b. Water in the oil	a. See 1a, 1b, 1c, 1d b. Check reservoir and/or heat exchange
3. Pump or oil overheating	a. Oil supply too thin b. Oil supply contaminated c. Pump cavitating d. Pump drive shaft excessively misaligned with pump driven shaft e. Pump drive shaft axially loaded by driving shaft (Prime Mover) f. System relief valve bypassing	a. Drain and fill with proper viscosity oil b. Drain, clean filter, & fill with clean oil c. See 1a, 1b, 1c, 1d d. Check alignment e. Check for clearance at ends of shafts, for shaft misalignment or worn driving keys, keyways or splines. If pulley drive check for belt alignment. f. Check relief valve setting (see 4c)
4. Low Flow	a. Pump cavitating b. Foaming oil c. Relief valve leaks or set too low d. Speed too low e. Oil too hot	a. See 1a, 1b, 1c, 1d b. See 2a, 2b c. Check relief valve for foreign particles d. Check prime mover speed e. Check temperature (see 3a, 3b, 3c, 3d, & 3e)
5. Failure to build pressure	a. Defective relief valve b. Low oil supply	a. Check and reset or replace b. Fill reservoir

Disassembly Instructions

1. Clean unit thoroughly with solvent, kerosene, or other non-corrosive cleaning fluid, which will not affect rubber components.
2. Scribe a line across the three sections of the pump to act as a guide in reassembly.
3. Remove the six screws (1). Remove the key (14) from the drive shaft. (Four screws in "D" series.)
4. Remove the front cover (4) by lightly tapping the flange with a soft metal hammer.
5. The center section (11) will remain attached to either the front cover (4) or back cover (21). Place the drive gear (13 or 15) into the unseparated sections, and while holding the center section (11), tap lightly to separate. Be careful to avoid cocking on the dowel pins (5).
6. Remove wear plate (9) and thrust plate (16).
7. Mark the front cover island next to the pressure vent hole in the heat shield (8), gasket (7), and V-seal (6) to act as a guide in reassembly. The location of this vent hole determines pump rotation.
8. Use a small diameter wire (a paper clip will do) to remove the phenolic heat shield (8), the paper compound gasket (7) and the rubber V-seal (6). Discard these parts and replace when pump is reassembled.
9. Remove both o-rings (10 and 17) and discard. They also should be replaced.
10. Do not remove shaft seal (3) in the front cover (4) unless it is damaged or leaking. If seal is to be replaced, use great care not to damage the seal recess or bearing. Heating the cover in an oven to 250°F will reduce the press fit.
11. If flow control is defective replace as a cartridge.
12. If relief valve is defective replace as complete relief valve unit.

Inspection**Drive (13 or 15) and Driven (12) Gear Assemblies**

Inspect shafts for roughness in the bearing and sealing areas. Measure for wear. Minimum acceptable .4998" in "D"; .7492" in "H"; and .9365" in "M". 5J surface finish maximum.

Inspect keyway, keys or splines for damage or excessive wear.

Inspect the gear end faces, outside diameter and teeth for roughness and score marks. The O.D. of the "D" gears must be 1.2395" minimum. "H" gears must be 1.7140" minimum and the "M" gears 2.1047" minimum. For minimum gear widths see Table (A).

Be sure snap rings are secure; break any sharp edges on the sides of the gears.

Gears and shafts are available only as assemblies. One gear assembly may be replaced separately if the other is in good condition.

Table A:

"D" SERIES		"H" SERIES		"M" SERIES	
Size	Minimum Gear Width	Size	Minimum Gear Width	Size	Minimum Gear Width
D05	.1875"				
D07	.2770"	H25	.4531"		
D09	.3463"	H31	.5663"	M09	1.0756"
D11	.4309"	H39	.7079"	M11	1.3446"
D14	.5412"	H49	.8849"	M14	1.6807"
D17	.6655"	H62	1.1072"		
D22	.8597"	H77	1.3840"		
D27	1.0562"	H90	1.6740"		

Front Cover (4) and Back Cover (21) Assemblies

If any bearing bore diameter exceeds .5015" in the "D" Series; .7518" in the "H" Series; or .9394" in the "M" Series, the cover should be discarded. Bearings are not supplied separately.

Replace the shaft seal (3) only if it shows excessive wear or cracking. Check all internal threads for damage.

Bearings must be below the cover faces and show no signs of contact with snap rings on gear shafts.

If bearings are scored, rough, or show signs of heat discoloration, the cover assemblies should be replaced.

Center Section (11)

Inspect the wall of gear bore diameters for excessive wear or score marks. The center section gear bores will show signs of wear on the inlet side of the pump. A wear ridge will develop at the end of the gear bore where the thrust plate is located. This wear ridge should not exceed 1/32".

Lightly tap the faces to remove any nicks or burrs. Do not break inside edges.

Wear Plate (9) and Thrust Plate (16)

Inspect bronze wear surfaces for excessive roughness or heat discoloration. If wear ridges exceed .0005", discard and replace.

General

The following parts should be replaced at every major overhaul; Wear Plate (9), Thrust Plate (16), Fiber Heat Shield (8), Paper Gasket (7), V-Seal (6), and O-rings (10 and 17). The shaft seal (3) should be replaced only when necessary.

Reassembly Procedure

1. All parts must be thoroughly cleaned prior to reassembly by dipping in solvent and brushing to remove all traces of contamination. Pump should be assembled in a dirt free area.
2. Install shaft seal (3), if it was removed, in front cover with the spring loaded lip facing inward. Force seal into place, using a flat steel rod slightly smaller in diameter than the O.D. of the seal. This will permit the tool to enter the seal recess and bottom the rotary seal on the stop. (The front cover (4) must be backed up on a smooth, clean surface to prevent damaging its face.) The load to force seal into place should be applied exactly in line with the housing seal bore to prevent bending the seal steel retainer, and/or scoring the seal housing bore.
3. Install the V-seal (6), the gasket (7), and heat shield (8) into the front cover cavity as follows:
 - The small vent hole through all of these parts shall be in line and positioned next to the scribe mark on the island previously made during disassembly. This position locates the vent holes on the outlet side of the pump.
 - The lips on the V-seal shall face toward the cavity and be tucked into the groove with the aid of a dull tool to prevent damage to the rubber surface. A small screw driver can be used.
 - The gasket shall be pressed firmly toward the bottom of the cavity with the thumbs so as to insure all of its perimeters are completely within the groove to avoid interference with subsequent assembly. The heat shield shall be firmly pressed toward the bottom of the cavity with the thumbs to provide sufficient space for the wear plate.
4. Install o-ring (10) into the groove provided in front cover face. Oil the o-ring and stretch it slightly, if necessary, so that it will remain in its groove.
5. Install the wear plate (9) with the bronze surface against the gears and the small vent hole in line with the hole in the heat shield. Press the wear plate. The wear plate shall be sufficiently within the oval cavity so that it is axially retained.
6. Install drive gear (13 or 15) and driven gear (12) assemblies into the front cover. Apply oil to the shaft at the drive end to prevent damage to the shaft seal caused by sharp edges on the drive shaft passing through the shaft seal. An oil coated shaft, rotated slowly, will usually cause no damage to the seal. Check to see that the shaft seal lip and spring is not pushed out by the shaft.
7. Check wear plate to insure it is still seated into its oval cavity and install the center section (11) over the gears until it engages the wear plate. Center section must be positioned so that the previously scribed lines on the housing exteriors are in line with those scribed on the front cover. The small slot located midway between the bores should align with the small vent hole in wear plate. The face containing the slot shall be in contact with the wear plate. Then, install dowel pins (5) and add a generous amount of clean oil into the gear cavities. Rotate gears to distribute the oil.
8. Position the thrust plate (16) on top of the gears in the center section, with the bronze face toward the gears. The open side should be toward the inlet.
9. Install o-ring (17) into its back cover face groove. Oil the o-ring, the cover face, and the bearings. Install the back cover so that the scribe marks are in line with the marks on the center section and front cover.
10. The housing retaining screws shall be alternately tightened to 190-210 in. lbs. on the "D" Series; 190-210 in. lbs. on the "H" Series; and 355-375 in. lbs. on the "M" Series. Add a generous amount of clean oil into both ports to insure the pump is adequately lubricated. Rotate the drive shaft to distribute the oil and check for freedom of shaft rotation. Shaft shall be free to rotate with the help of a short wrench. (100 in. lbs. maximum)

Testing Procedure

After pump has been re-installed run for 2-3 minutes before pressurizing. Try to apply pressure gradually for an additional five minutes, but do not pressurize for longer than 5 seconds at a time.

WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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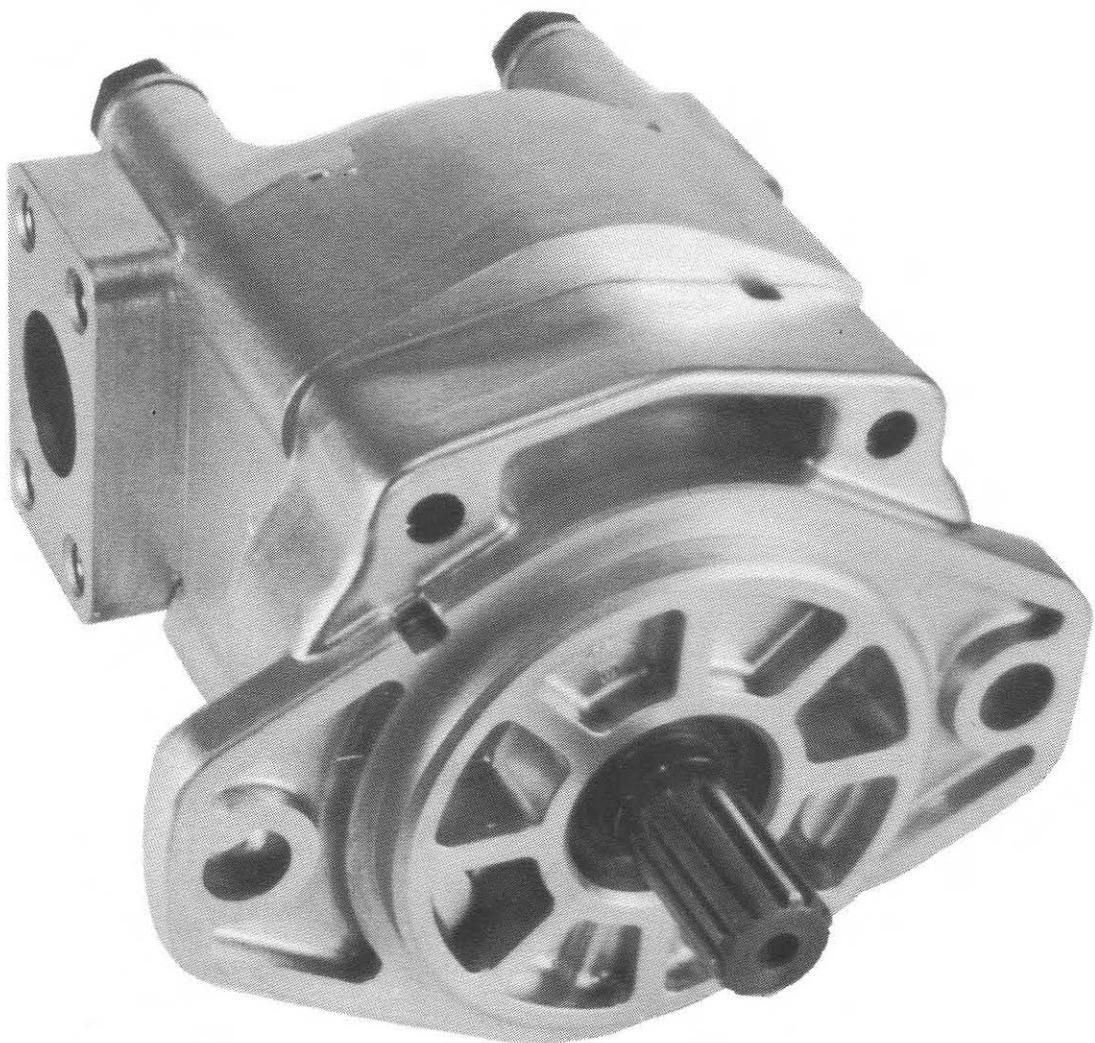
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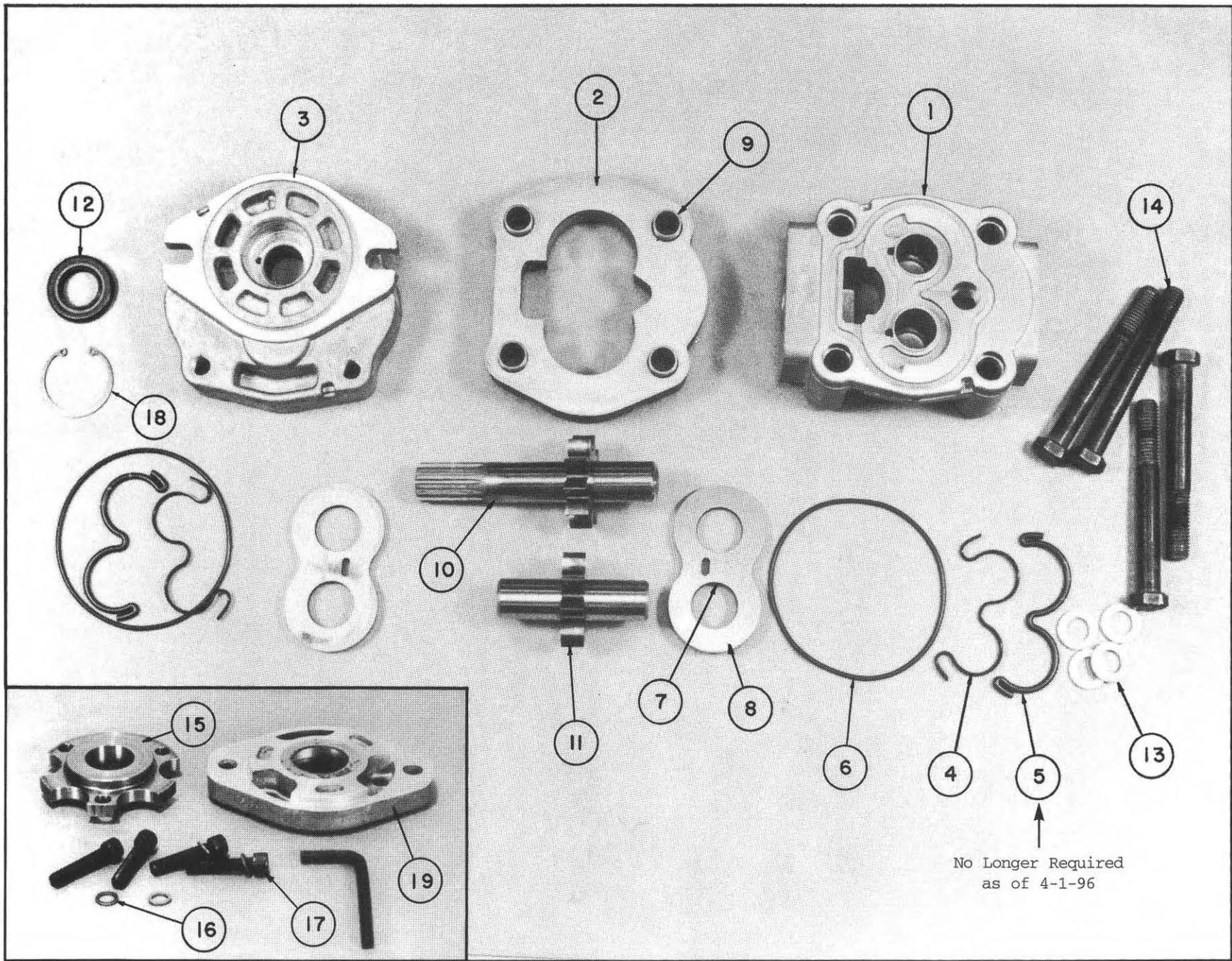
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P16 SERIES



Service Instructions



PARTS IDENTIFICATION — P16

ITEM NO.	NAME OF PART	ITEM NO.	NAME OF PART
1	COVER PLATE	28	
2	GEAR PLATE	29	
3	FLANGE PLATE	30	
4	BACK-UP RING	31	
5	O-RING, PRESSURE BALANCE	No Longer Required as of 4-1-96	32
6	O-RING, FLANGE & COVER		33
7	O-RING, PRESSURE PLATE		34
8	PRESSURE PLATE		35
9	DOWEL		36
10	DRIVE GEAR		37
11	IDLER GEAR		38
12	SEAL, SHAFT		39
13	WASHER		40
14	CAPSCREW		41
15	ADAPTER, MOUNTING		42
16	WASHER		43
17	CAPSCREW		
18	SNAP RING		
19	ADAPTER, FLANGE		
20			
21			
22			
23			
24			
25			
26			
27			

DISASSEMBLY AND ASSEMBLY INSTRUCTIONS FOR P16 PUMP

DISASSEMBLY INSTRUCTIONS

1. Using solvent and brush, clean outside of pump thoroughly. (Fig. 1)

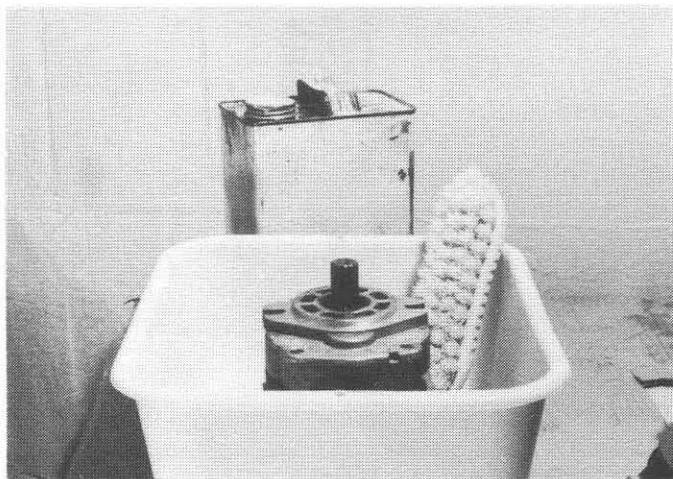


Fig. 1

2. Mark the pump plates nearest to drive shaft extension side. These marks can be used for matching in reassembling pump. (Fig. 2)

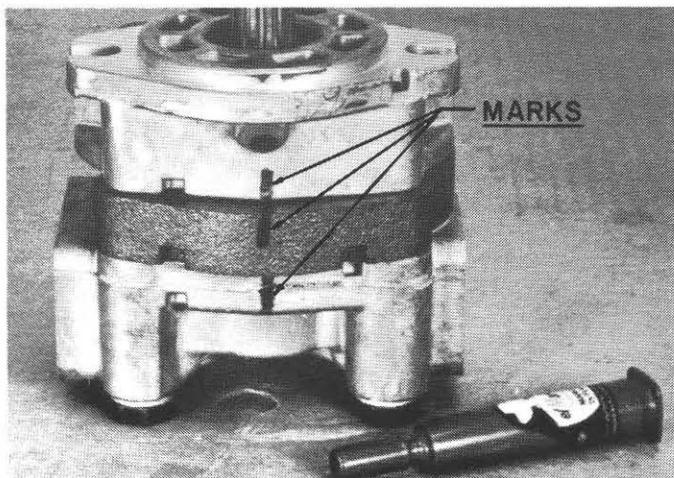


Fig. 2

3. Place pump in machinist vise. Use blocks of wood or cardboard between pump and vise jaws. (Fig. 3)

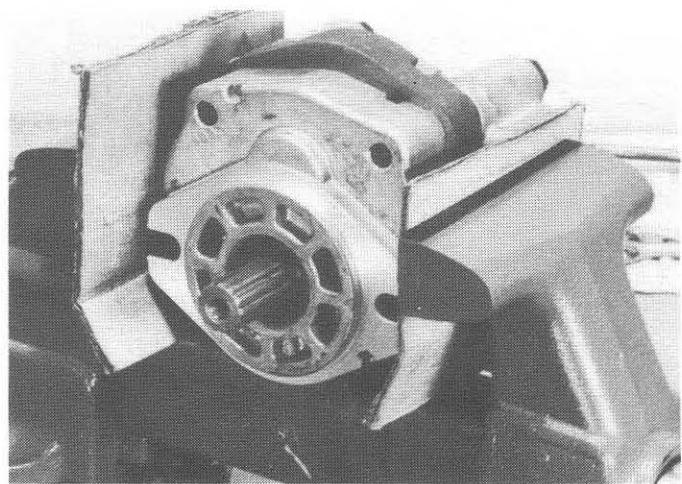


Fig. 3

4. If your pump has a mounting adapter (15), remove allen-head capscrews (17), washers (16) and flange adapter (19). (Fig. 4)

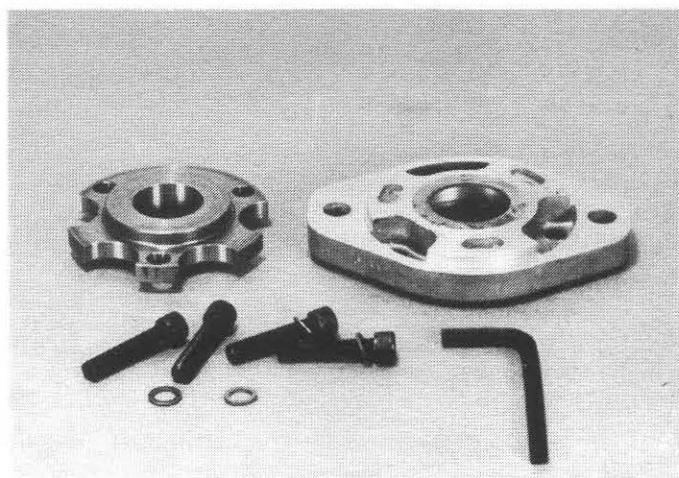


Fig. 4

5. Using 3/4 wrench, loosen and remove capscrews (14) and washers (13). (Fig. 5)

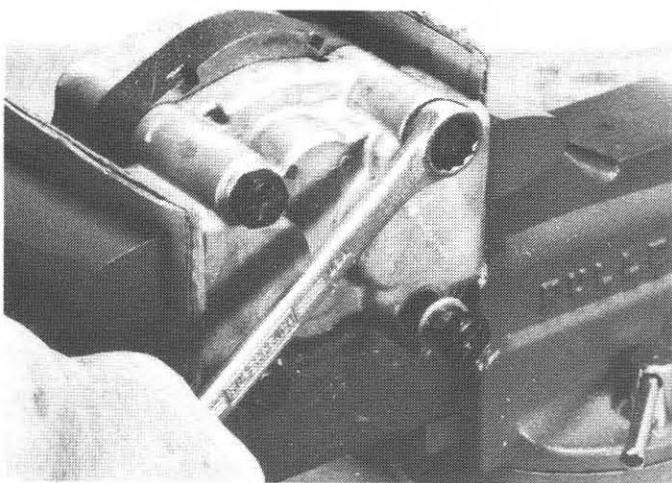


Fig. 5

7. Remove body o-ring (6), pressure balance o-ring (5), and back-up ring (4). (Fig. 7)

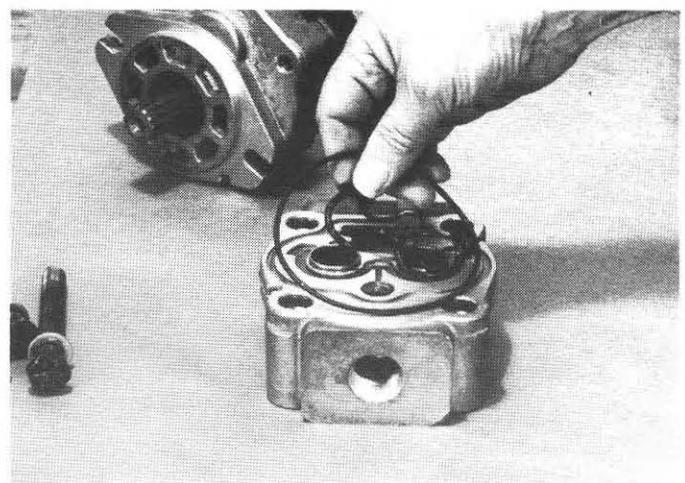


Fig. 7

6. Remove pump from vise. Using wood mallet or plastic hammer, tap connector bosses to loosen cover plate (1). Lift plate straight up off gear journals. (Fig. 6)

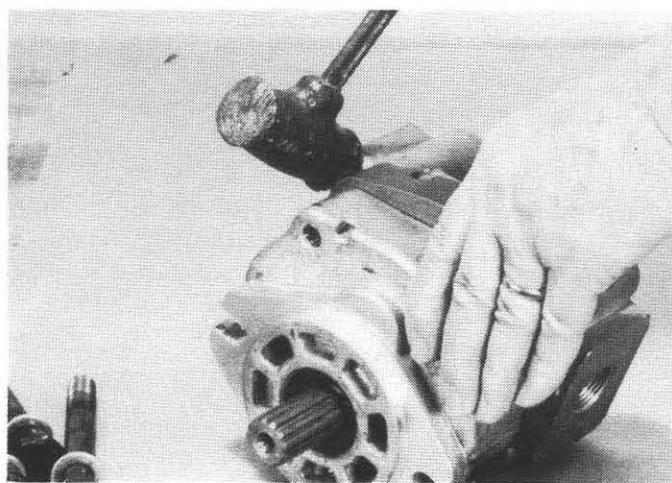


Fig. 6

8. Remove pressure plate (8). Remove o-rings (7) from journal bores of pressure plate. (Fig. 8)

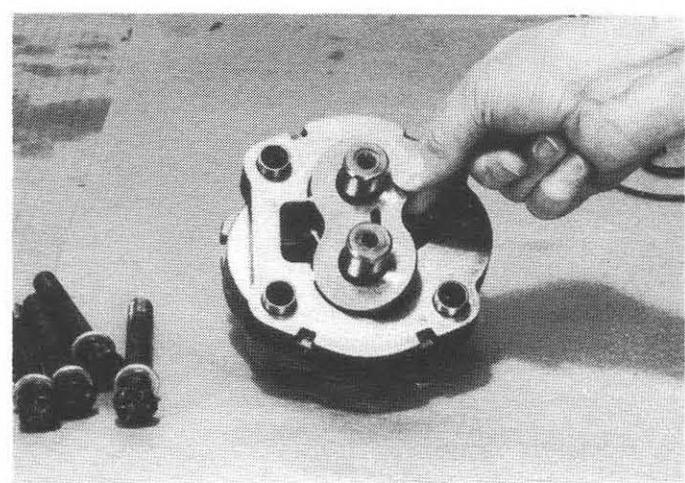


Fig. 8

9. Lift drive gear (10) and idler gear (11) straight up out of gear plate. (Fig. 9)

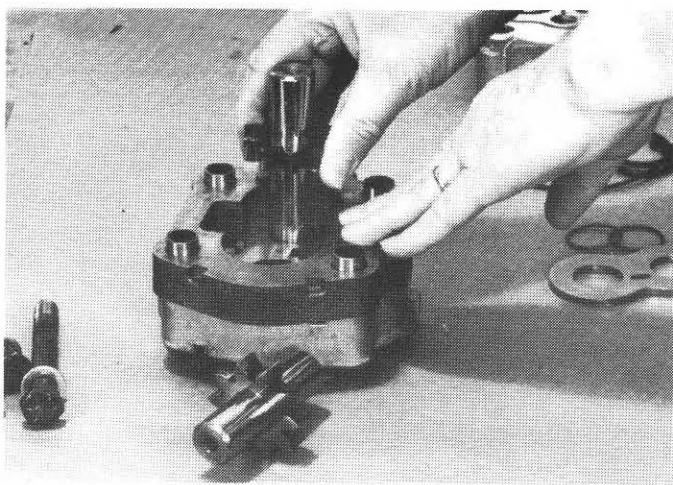


Fig. 9

11. Dowels (9) are pressed into gear plate. There are four dowels on each side and unless gear plate is replaced it is not necessary to remove them. To remove the dowels use a rod or punch and hammer to drive them out. Place driver inside of dowel and against end of dowel on opposite side and tap it out. (Fig. 11)

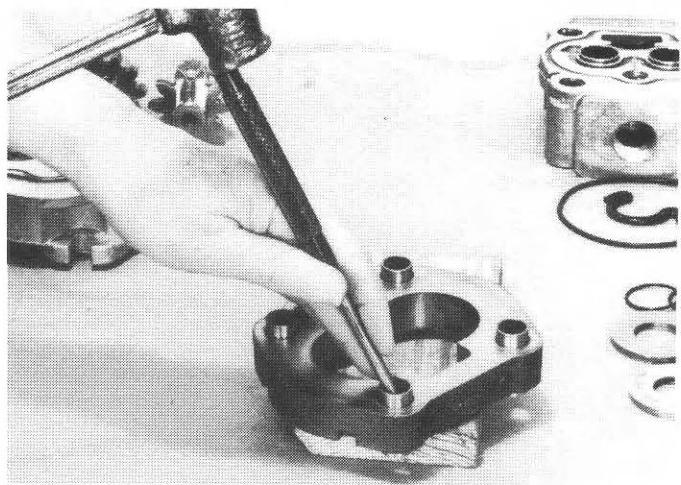


Fig. 11

10. Tap edges of gear plate (2) with wood mallet or plastic hammer to loosen. If gear plate does not move by this method, lift the plates up off work bench slightly and tap the ears of flange plate lightly. (Fig. 10)

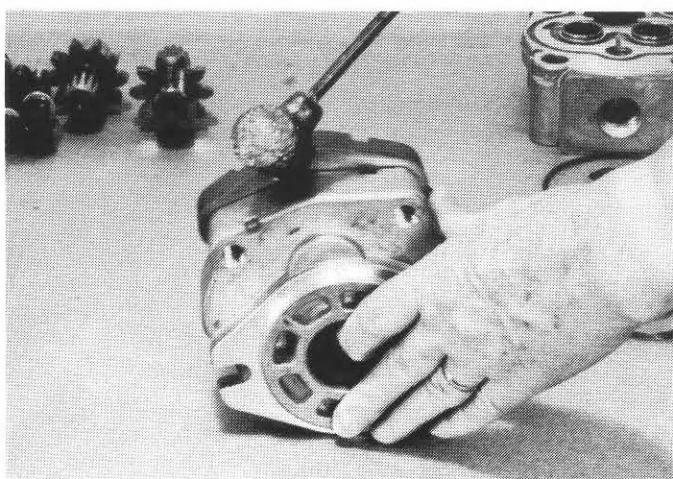


Fig. 10

12. To complete the disassembly, follow steps 7 and 8. (Fig. 12)

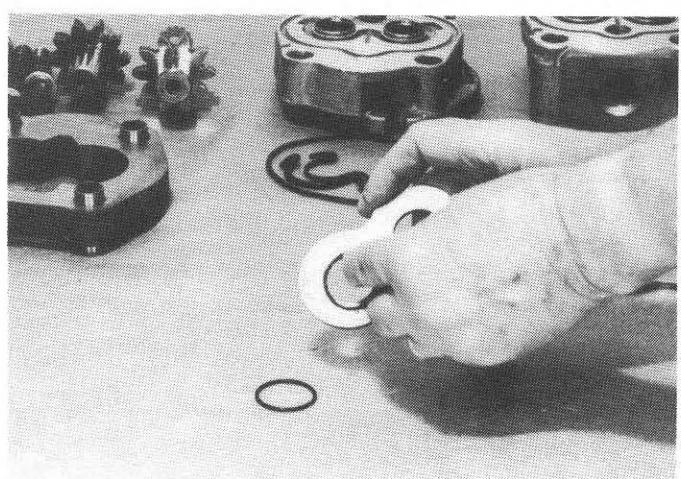


Fig. 12

13. For shaft seal removal and replacement, see seal replacement section.

14. Wash all pump parts in clean solvent and wipe dry with clean shop towel or blow dry with shop air.

15. Visually inspect all parts. For detailed instructions, see parts inspection section.

18. If for any reason gear plate (2) had to be replaced, dowels (9) must be pressed into both sides of replacement gear plate before assembling it to cover plate (1). Dowels can be tapped in with hammer, but it is best to use dowel guide and press. Whichever method is used, make sure they are straight in dowel bores. If press is used, do not apply rapid force on dowels. If hammer is used, do not drive the dowels in aggressively. Tap them lightly until they are against shoulder. (Fig. 14)

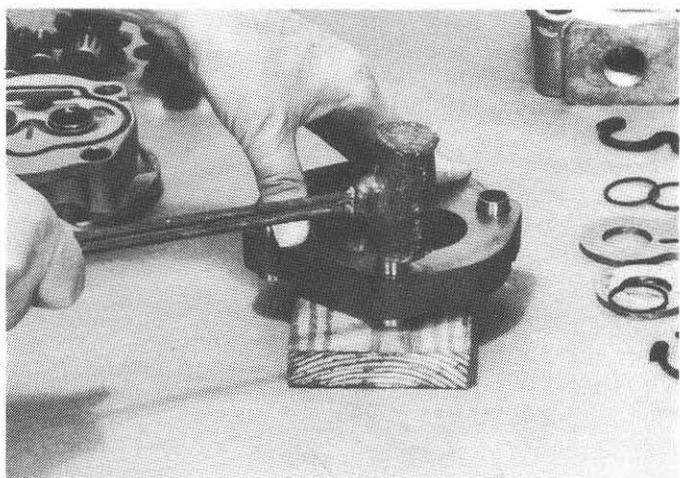


Fig. 14

16. Each pump is assembled and tested for a specific direction of rotation. Direction of rotation can not be changed without changing flange (3).

17. Install o-ring (6) in cover plate (1). After o-ring has been placed in groove, spread a light coat of clean heavy grease on the o-ring to hold it in place. (Fig. 13)

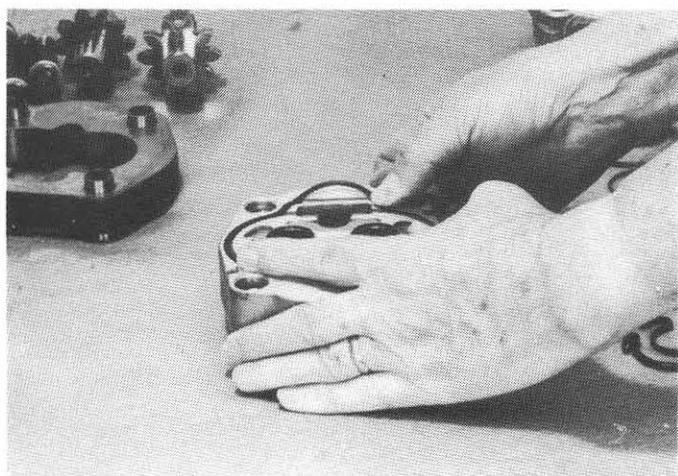


Fig. 13

19. With matching marks made in step 2 toward you, and the four cast recesses in the outer edge of gear plate toward cover plate, line up dowels. Tap gear plate lightly until it is against O-ring in cover plate. (Fig. 15)

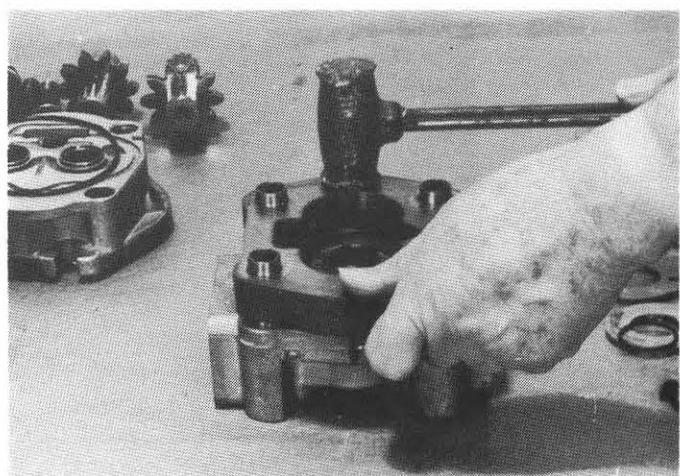


Fig. 15

20. Install back-up ring (4) and o-ring (5) as shown in figure 16.

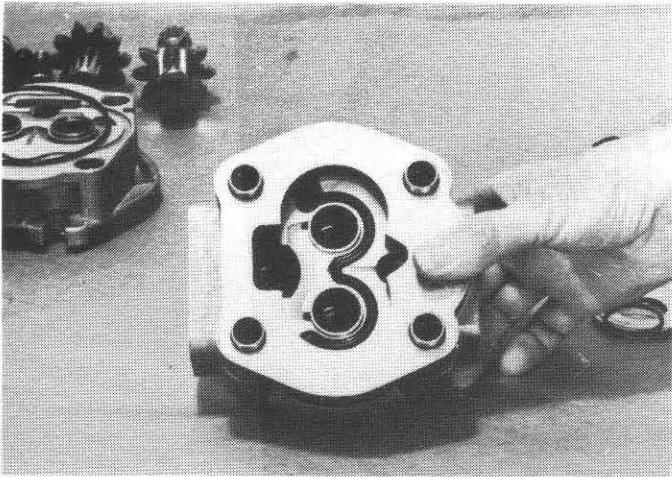


Fig. 16

22. Install drive gear (10) in gear bore nearest to matching mark and idler gear (11) in opposite bore. (Fig. 18)

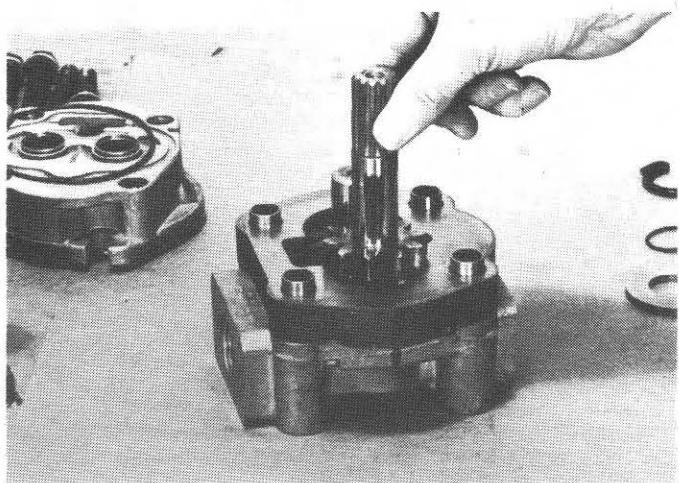


Fig. 18

21. Install o-ring (7) in pressure plate (8). With trap (small oblong hole) in pressure plate toward discharge side of gear plate and bronze side up, slide pressure plate down gear bores. (Fig. 17)

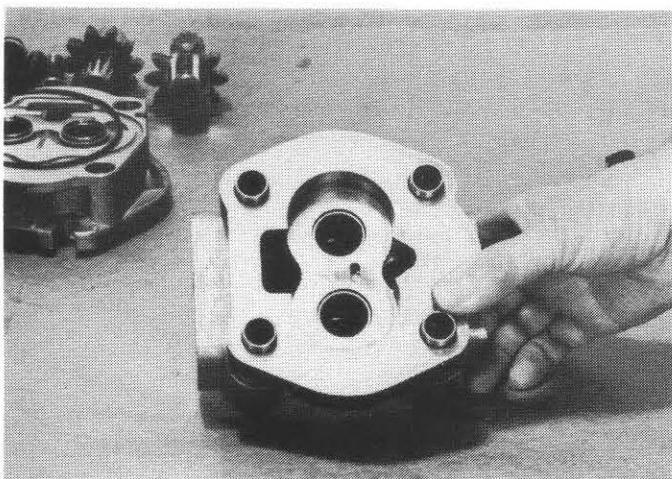


Fig. 17

23. Install o-ring (7) in pressure plate (8). With trap toward discharge side and bronze side down, place pressure plate down against gear faces. (Fig. 19)

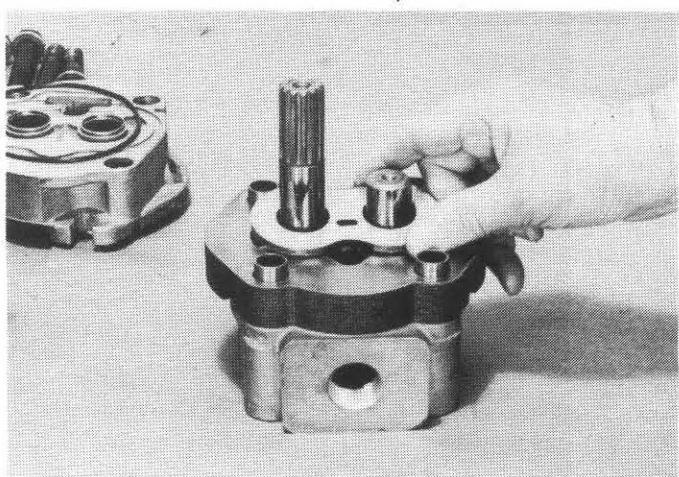


Fig. 19

24. Install back-up ring (4), and o-ring (6) in flange plate (3). Use clean heavy grease to hold o-rings in grooves.
(Fig. 20)

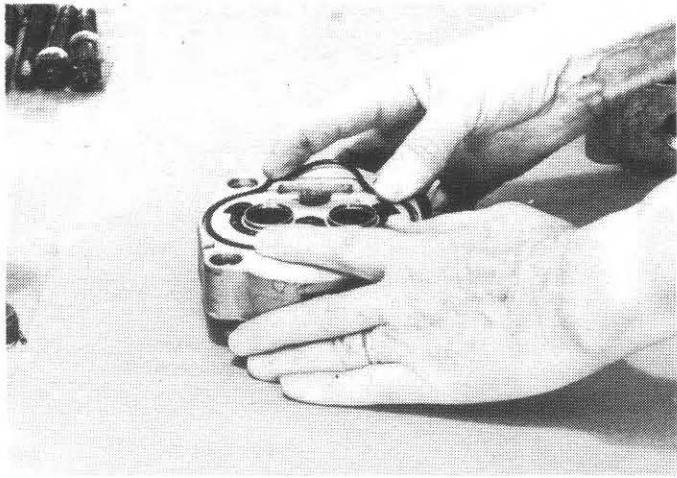
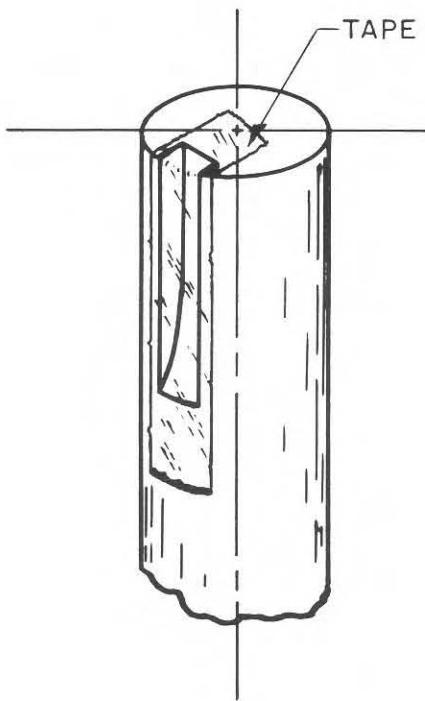


Fig. 20

NOTE: Use tape to cover keyway before installing flange to avoid nicking seal lip.



25. If extension end of drive shaft is splined, coat splines with clean heavy grease to protect seal as flange plate (3) slides down shaft. If extension end is keyed, use a piece of tape to cover keyway to protect seal.
(Fig. 21)

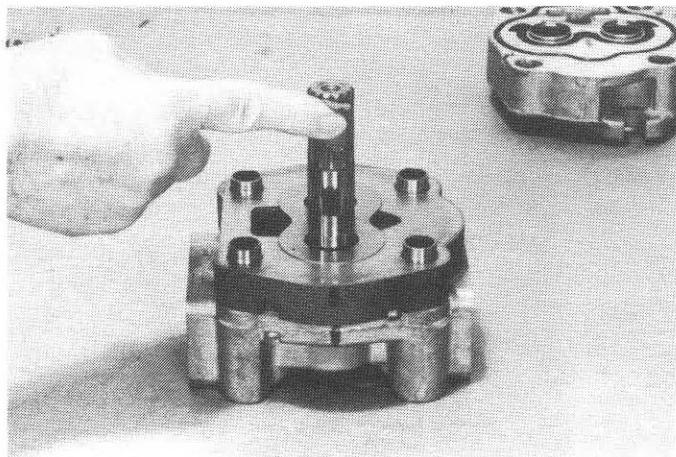


Fig. 21

26. With o-rings in flange plate (3) facing down and keeping plate true with shafts, slide it down until it contacts dowels in gear plate. Bump flange very lightly with hands or plastic hammer to force the plate down on dowels, at the same time making sure grease is holding o-rings in grooves. Once plate is in position if keyway protection was used, remove from shaft. (Fig. 22)

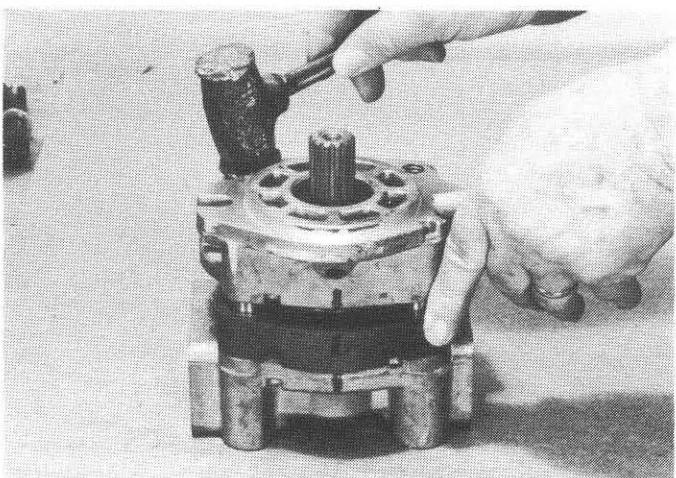


Fig. 22

27. Coat capscrew (14) threads with clean hydraulic oil. Install washers (13) on capscrews and screw them in and torque to 80 ft. lbs. (Fig. 23)

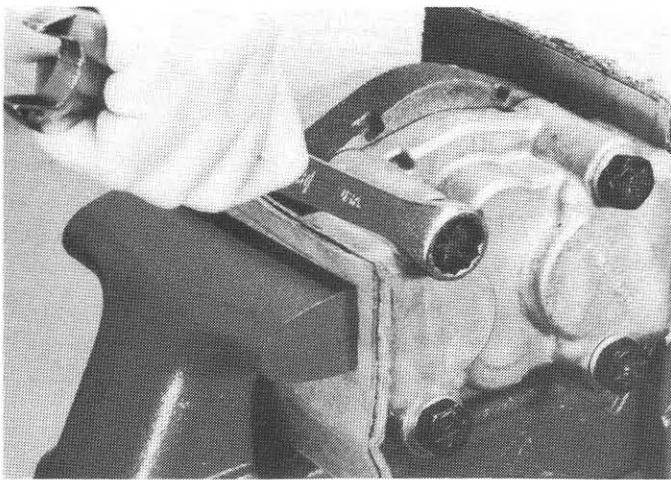


Fig. 23

28. Using twelve inch wrench, check to see if shaft will turn. It will be tight but should turn free with a 15 lbs maximum of force on wrench. (Fig. 24)

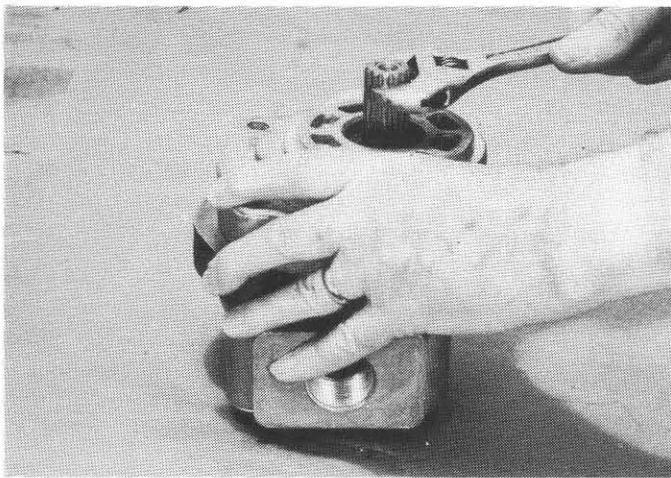


Fig. 24

SHAFT SEAL REPLACEMENT INSTRUCTIONS
FOR P16 SERIES

1. Remove pump from machine. Plug the suction and discharge ports and wash the pump thoroughly. If shop air is available, blow all contaminants from shaft seal area.
2. If only shaft seal replacement is to be made, it is not necessary to completely disassemble the pump.
3. For adaptor equipped models, loosen and remove capscrews and washers. Tap the mounting adaptor loose with a soft hammer and slide it off the shaft. Remove the flange adaptor also, if one is used.
4. Loosen and remove the four capscrews from the rear of the pump. Hold the gear plate and valve body together and tap the flange plate with a soft hammer to loosen (Fig. 1)

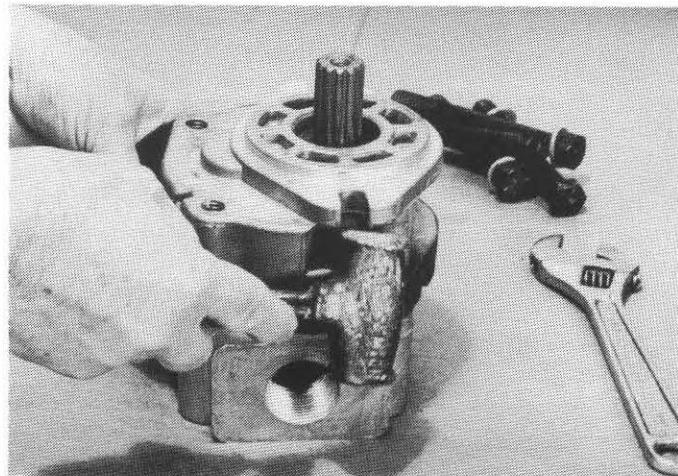


Fig. 1

5. Slide flange plate off the shafts and remove the plate o-ring, "E" shaped o-ring, and back-up strip. Also remove the shaft seal snap ring from seal bore. Pumps with mounting adaptors do not get shaft seal snap ring. (Fig. 2)

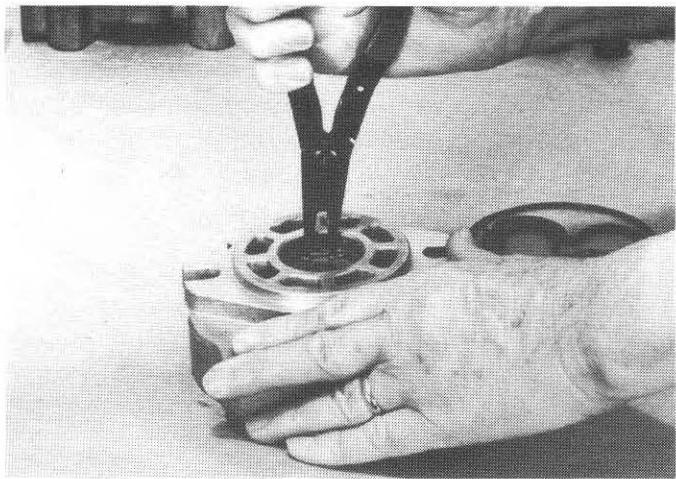


Fig. 2

7. Slide a punch of appropriate size through the bearing and against the seals metal casing. Hold the punch away from the bearings and drive the seal out without damaging seal bore or bearing. Move the punch around the seal as it is driven out. Do not allow the punch to rest against the seal bore or bearing while driving the seal out. (Fig. 4)

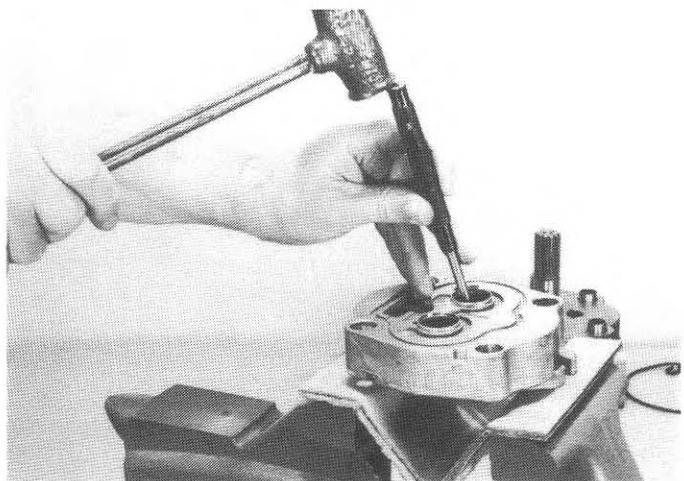


Fig. 4

6. Place flange plate in machinist vise. Use cardboard between jaws of vise and flange plate. (Fig. 3)

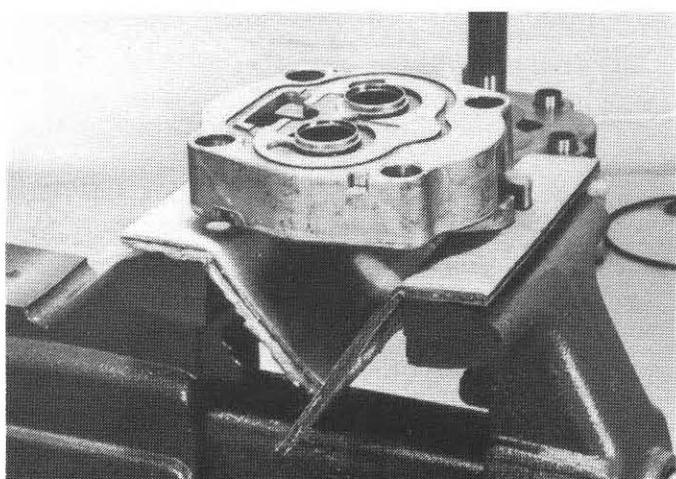


Fig. 3

8. Check the seal bore for scratches. If scratches are apparent, us a four hundred grit sandpaper to clean up the bore. Do not use coarse grit sandpaper. It will cut heavy grooves in the bore and will allow the seal to leak around the O.D.

9. Wash the flange plate in clean solvent and wipe it dry with clean shop towels or blow it dry with shop air.

10. If an arbor press is available, use it to press the new seal into flange bore. If the press is not available, place the flange in a machinist vise with the seal bore facing the movable jaw. Arrange blocks of wood on each side of the protruding ends of the bearings at the side next to fixed jaw to prevent pressing on the bearings while the seal is being pressed in. (Fig. 5)

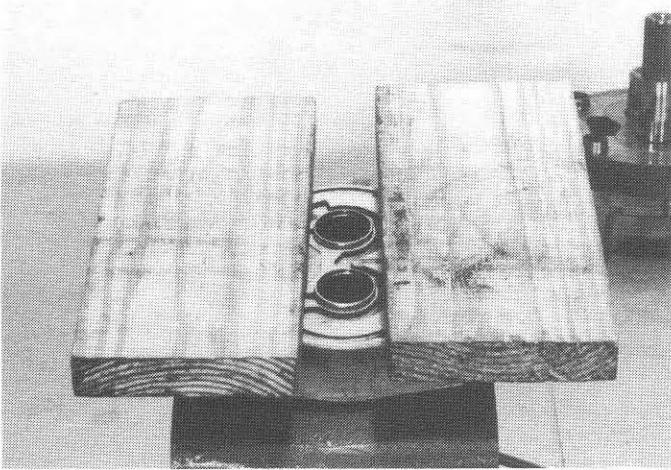


Fig. 5

11. Center the seal over the seal bore with metal face of the seal facing movable jaw. Place clean block of wood against seal and tighten the vise slowly until wood block is against the flange. Make sure the seal is started and pressed straight into the bore. (Fig. 6)

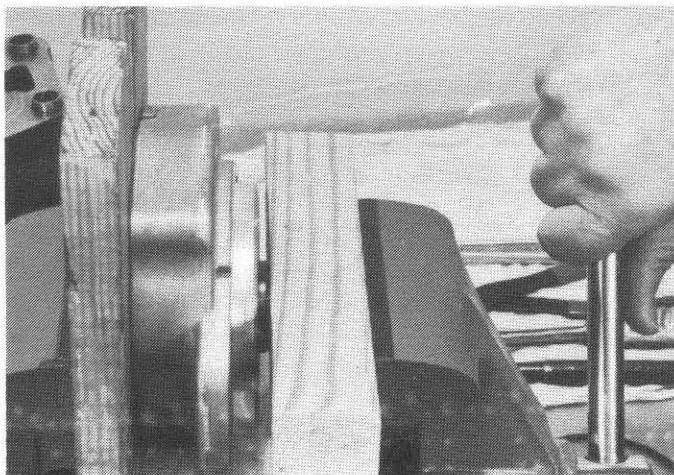


Fig. 6

12. Loosen the vise and remove the block of wood. Place a socket wrench (having an O.D. just slightly smaller than seal bore) against seal. Tighten vise against socket and press seal in until seal has just cleared snap ring groove in seal bore. Apply two or three drops of #290 Loctite against seal bore and O.D. of seal. Hold the flange at a 45 degree angle and rotate it slowly to allow the loctite to flow all the way around the O.D. of the seal. If your flange gets snap ring in seal bore, install the snap ring and wipe the excess loctite out of seal bore and any that might have gotten on seal lip. (Fig. 7)

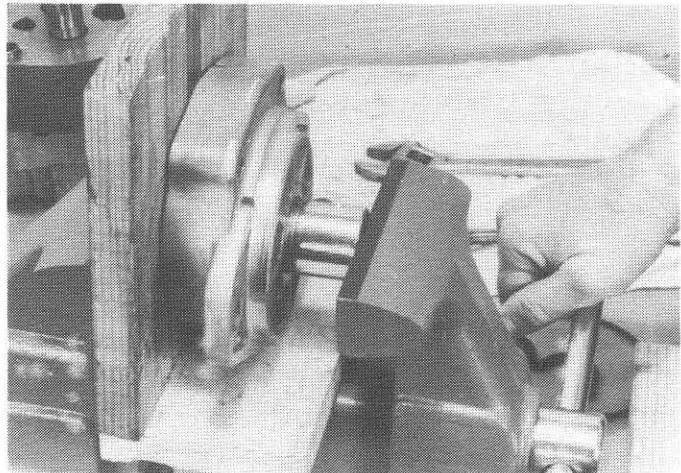


Fig. 7

13. Install flange o-ring, and "E" shaped back-up strip. Use clean heavy grease to hold the o-rings and back-up strip in position. (Fig. 8)

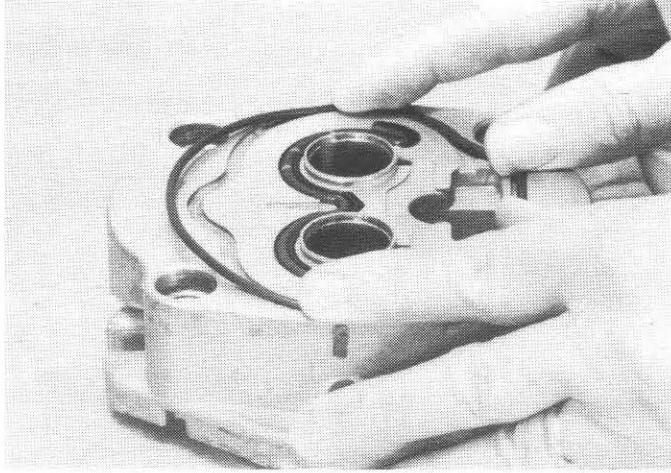


Fig. 8

14. If extension end of the drive shaft is splined, coat the spline with clean grease. If it has keyway, cover the keyway with transparent tape. This will protect the rubber sealing lip as it slides down the shaft. If tape is used, make sure all of the tape is removed from the shaft.
15. After flange plate has been installed, screw the cap-screws in and torque them to 70 to 75 lb. ft.
16. If your pump uses the adaptor and flange mount arrangement, reinstall the adaptors, cap-screws, and washers. Torque the capscrews to 35 lb. ft.

INSPECTION OF PARTS

1. Visually inspect all parts. It is not necessary to set up gauges to check the amount of wear on the pump parts. After a visual inspection those parts which are in questionable condition should be replaced with new ones.
2. Note the bores in the gear plate. On the discharge side you will see a milled groove in the center of the plate. During the initial break-in at the factory, the gears cut into the suction side. Nominal depth of this cut is .008" and should not exceed .015". Small bits of metal are sometimes pulled out of the surface during break-in. This is not detrimental. If the cut is deeper than .015" or the plate is cracked or damaged in some other way, it should be rejected.
3. Examine the gears. If excessive wear is visible on the journals, sides, or faces of the gears, or at the point where the drive gear shaft rotates in the lip seal, reject them. If splines or keyways are excessively worn, replace the drive gear.
4. Examine the pressure plates. They should not show excessive wear on the bronze side. If deep curved wear marks are visible, replace the plate with new ones.
5. Shaft seals should be replaced. All o-ring seals and back-up rings or strips should be replaced with new.
6. Bearing i.d.'s should have a gray coating. If bronze can be seen shining through the teflon on the suction side, the bearings and plate they are in, should be replaced.

TROUBLESHOOTING GUIDE FOR GEAR TYPE HYDRAULIC PUMPS

IDENTIFICATION	CAUSE	CORRECTIVE CHECKS
<ul style="list-style-type: none"> 1. Sandblasted band around pressure plate bores 2. Angle groove on face of pressure plate 3. Lube groove enlarged and edges rounded 4. Dull area on shaft at root of tooth 5. Dull finish on shaft in bearing area 6. Sandblasted gear bore in housing 	<p>I. Abrasive wear caused by fine particles.</p> <ul style="list-style-type: none"> 1. Dirt (fine contaminants, not visible to the eye) 	<ul style="list-style-type: none"> 1. Was clean oil used? 2. Was filter element change period correct? 3. Were correct filter elements used? 4. Cylinder rod wiper seals in good condition? 5. Cylinder rods dented or scored? 6. Was system flushed properly after previous failure?
<ul style="list-style-type: none"> 1. Scored pressure plates 2. Scored shafts 3. Scored gear bore 	<p>II. Abrasive wear caused by metal particles.</p> <ul style="list-style-type: none"> 1. Metal (coarse) contaminants, visible to the eye 	<ul style="list-style-type: none"> 1. Was system flushed properly after previous failure? 2. Contaminants generated elsewhere in hydraulic system? 3. Contaminants generated by wearing pump components?
<ul style="list-style-type: none"> 1. Any external damage to pump 2. Damage on rear of drive gear and rear pressure plate only 	<p>III. Incorrect Installation</p>	<ul style="list-style-type: none"> 1. Did shaft bottom in mating part? 2. Any interference between pump and machine?
<ul style="list-style-type: none"> 1. Eroded gear plate 2. Eroded pressure plates 	<p>IV. Aeration — Cavitation</p> <ul style="list-style-type: none"> 1. Restricted oil flow to pump inlet 2. Aerated oil 	<ul style="list-style-type: none"> 1. Tank oil level correct? 2. Oil viscosity as recommended? 3. Restriction in pump inlet line? 4. Air leak in pump inlet line? 5. Loose hose or tube connection near or above oil level in tank? 6. Excessive operation of relief valve?
<ul style="list-style-type: none"> 1. Heavy wear on pressure plate 2. Heavy wear on end of gear 	<p>V. Lack of Oil</p>	<ul style="list-style-type: none"> 1. Was oil level correct? 2. Any leaks in piping inside tank? 3. Any oil returning above oil level?
<ul style="list-style-type: none"> 1. Gear plate scored heavily 2. Inlet peened and battered 3. Foreign object caught in gear teeth 	<p>VI. Damage caused by metal object</p>	<ul style="list-style-type: none"> 1. Metal object left in system during initial assembly or previous repair? 2. Metal object generated by another failure in system?
<ul style="list-style-type: none"> 1. Pressure plate black 2. O-rings and seals brittle 3. Gear and journals black 	<p>VII. Excessive Heat</p>	<ul style="list-style-type: none"> 1. Was a valve stuck? 2. Was relief valve too low? 3. Was oil viscosity correct? 4. Was oil level correct?
<ul style="list-style-type: none"> 1. Broken shaft 2. Broken gear plate or flange 	<p>VIII. Over Pressure</p>	<ul style="list-style-type: none"> 1. Relief valve setting correct? 2. Did relief valve function?

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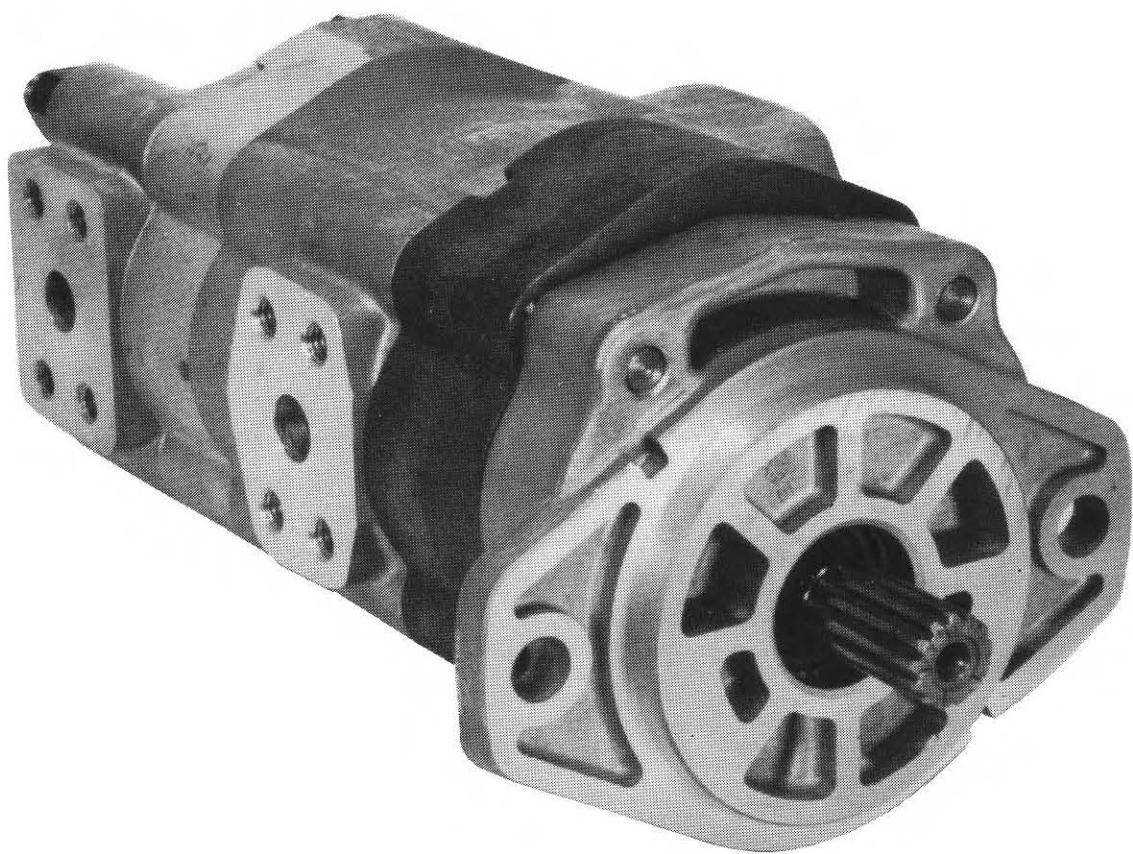
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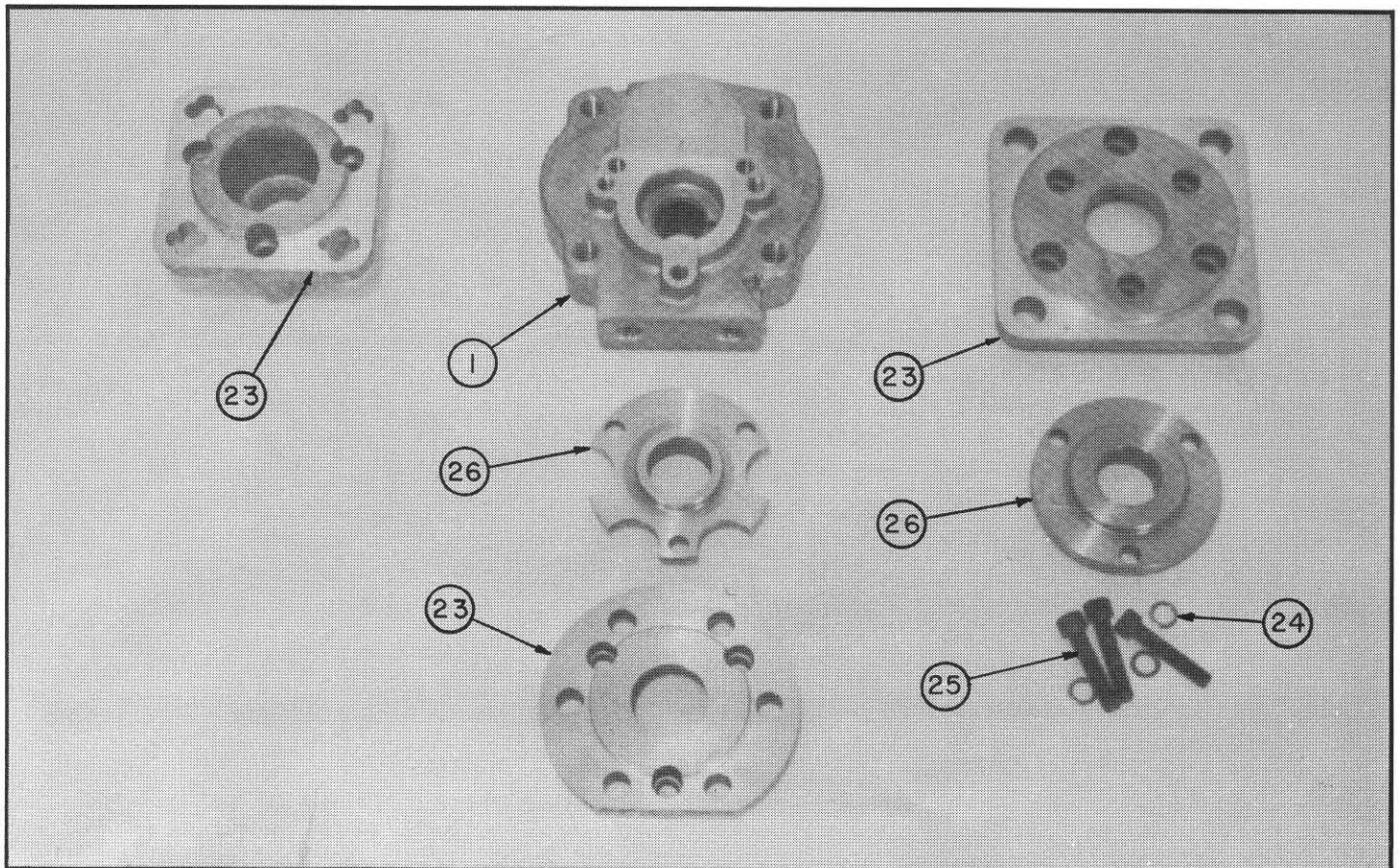
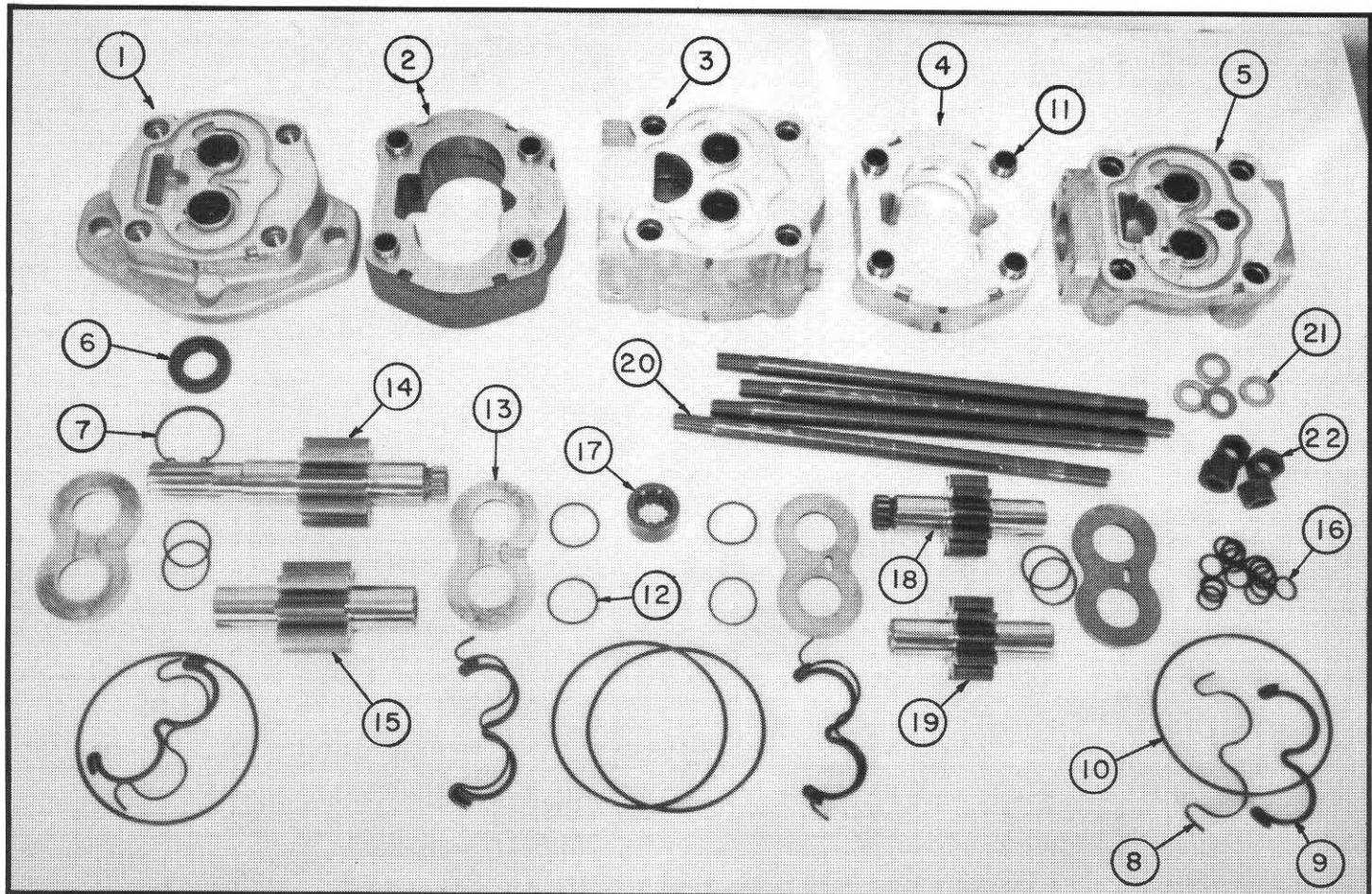
GRESEN®

TP16 SERIES



Service Instructions

Gresen Products • Parker Hannifin • Sarasota Facility
4675 Clark Rd. • Sarasota, FL 34233



PARTS IDENTIFICATION

ITEM NO.	NAME OF PART	ITEM NO.	NAME OF PART
1	Plate, Flange	28	
2	Plate, Front Gear	29	
3	Plate, Bearing	30	
4	Plate, Rear Gear	31	
5	Plate, Cover	32	
6	Seal, Shaft	33	
7	Snap Ring, Seal Retaining	34	
8	Strip, Back-Up	35	
9	O-Ring, Pressure Balance	36	
10	O-Ring, Plate	37	
11	Dowel	38	
12	O-Ring, Pressure Plate Bore	39	
13	Plate, Pressure	40	
14	Gear, Drive (Front Pump Section)	41	
15	Gear, Idler (Front Pump Section)	42	
16	O-Ring, Stud Stabilizer	43	
17	Coupling, Shaft		
18	Gear, Drive (Rear Pump Section)		
19	Gear, Idler (Rear Pump Section)		
20	Stud		
21	Washer, Stud		
22	Nuts, Stud		
23	Adapter, Mounting		
24	Washer, Capscrew		
25	Capscrew, Adapter Mounting		
26	Adapter, Flange		
27			

DISASSEMBLY AND ASSEMBLY INSTRUCTIONS
FOR TP16 SERIES PUMPS

DISASSEMBLY

1. Using solvent and brush, clean outside of the pump thoroughly.
2. Mark all pump plates on the side nearest the drive shaft extension. These marks will be used to correctly position the plates when you reassemble the pump. (Fig. 1)

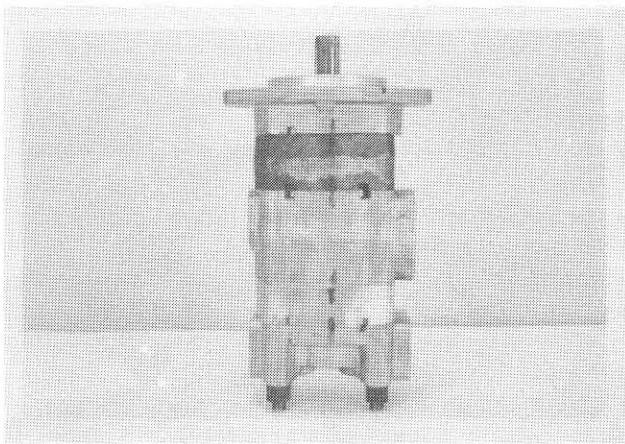


FIG. 1

3. Place the pump in a machinist vise. Protect the pump surfaces with wood blocks or heavy cardboard placed between the pump and vise jaws. (Fig. 2)

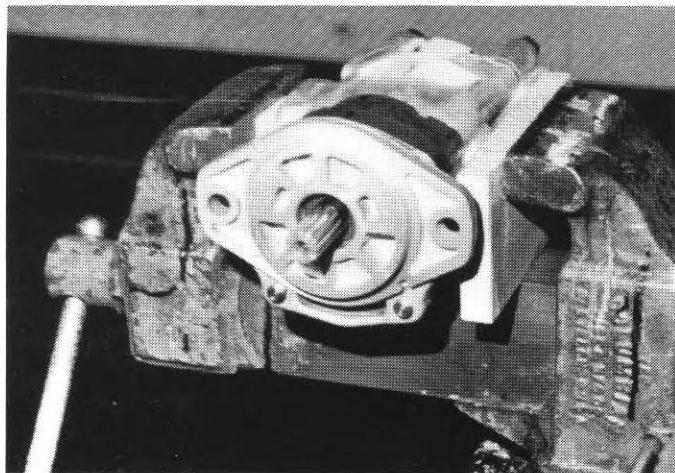


FIG. 2

4. If your pump has a mounting adapter, remove Allen head capscrews (25), washers (24), and mounting adapter (23). If it also has a flange adapter (26) behind it, remove that also. If your pump has no adapter but only a standard one-piece flange, disregard this step and continue with step five.
5. Use a 3/4" wrench to loosen and remove nuts (22) and washers (21). (Fig. 3)

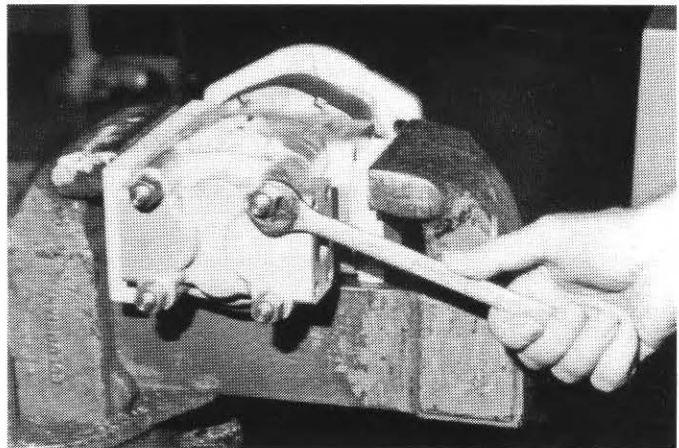


FIG. 3

6. Remove the pump from the vise. Use a plastic hammer and tap connector bosses to loosen cover plate (5). (Fig. 4)

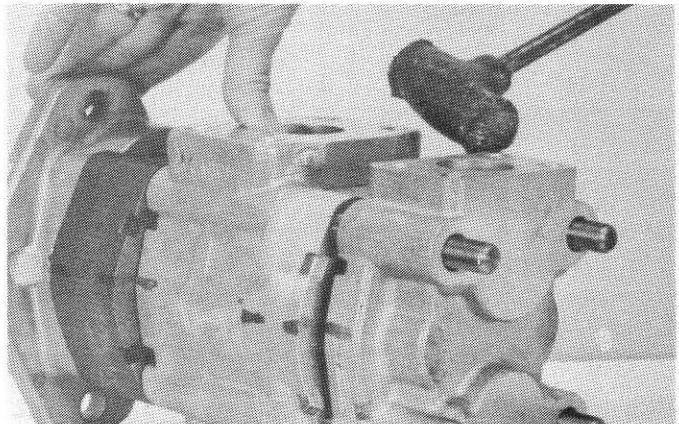


FIG. 4

7. Remove cover plate o-ring (10), pressure balance o-ring (9), and nylon back-up strip (8). (Fig. 5)

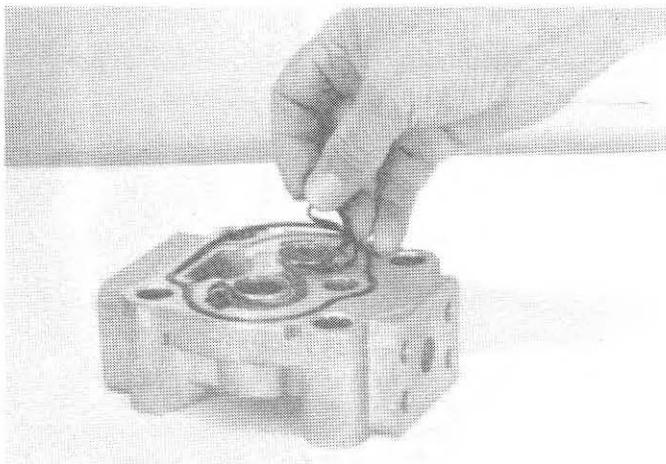


FIG. 5

8. Remove pressure plate (13). Remove o-rings (12) from the journal bores of the pressure plate. (Fig. 6)

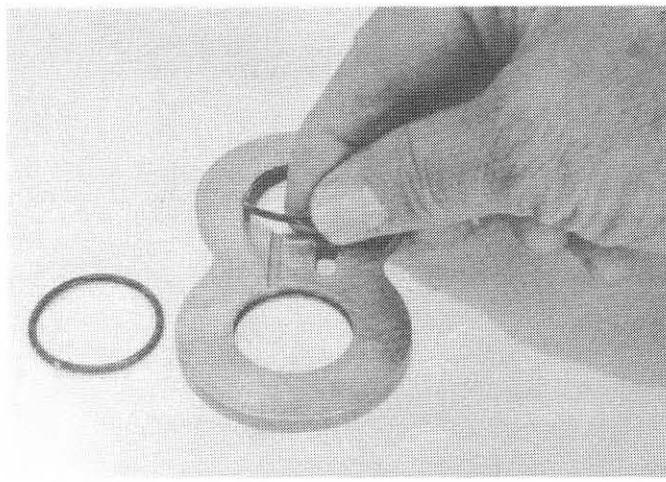


FIG. 6

9. Slide idler gear (19) and drive gear (18) straight up and out of the gear plate. (Fig. 7)

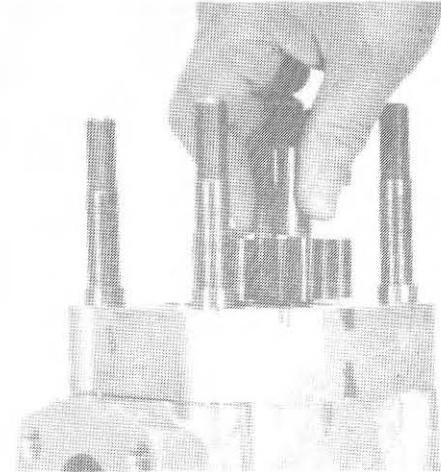


FIG. 7

10. Reach inside the gear plate and grasp pressure plate (13). Carefully start lifting it out of the gear bores. If it hangs as you move it up, work it gently back and forth until it will slide out freely. Remove o-ring (12) from the journal bores in the pressure plate. (Fig. 8)

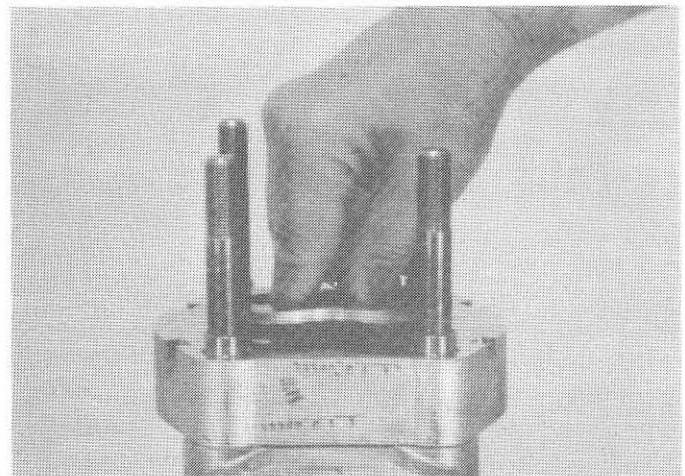


FIG. 8

11. Remove gear plate (4) by tapping on its exposed edges while holding the bearing plate. After it loosens, it can be lifted off. (Fig. 9)

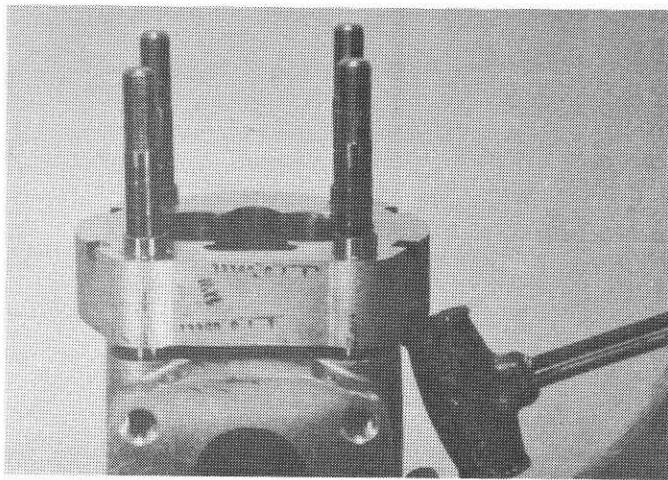


FIG. 9

12. Remove bearing plate o-ring (10), pressure balance o-ring (9), and nylon back-up strip (8). (Fig. 10)

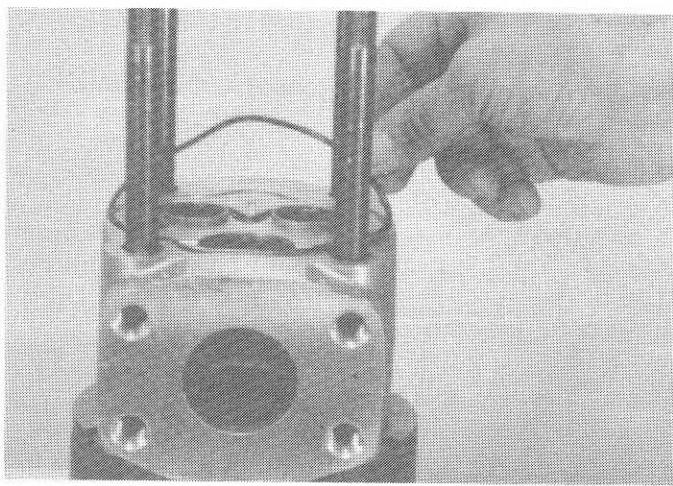


FIG. 10

13. Keep the parts from each pump section in separate groups. (Fig. 11)

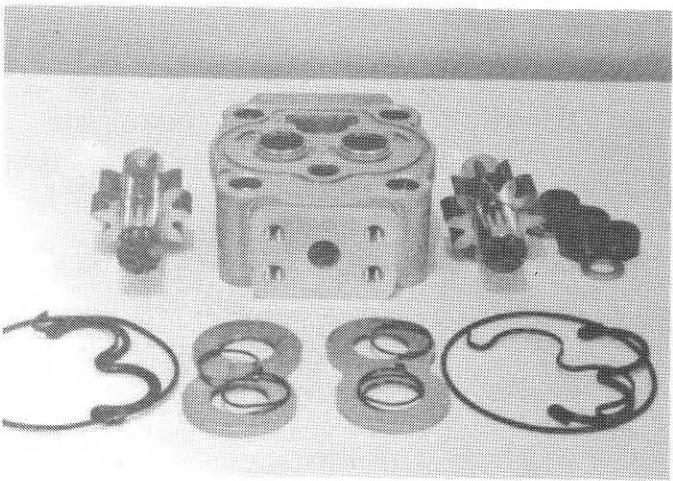


FIG. 11

14. While holding bearing plate (3), tap around the exposed edges of the gear plate. After the bearing plate loosens, remove it. (Fig. 12)

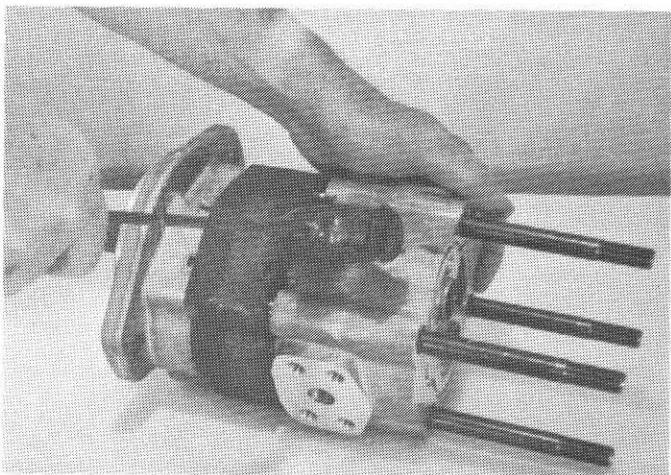


FIG. 12

15. Remove shaft coupling (17) from the suction port in the bearing plate. Remove o-ring stud stabilizers (16) from dowel bores in the bearing plate. Remove bearing plate o-ring (10), pressure balance o-ring (9), and nylon back-up strip (8). (Fig. 13)

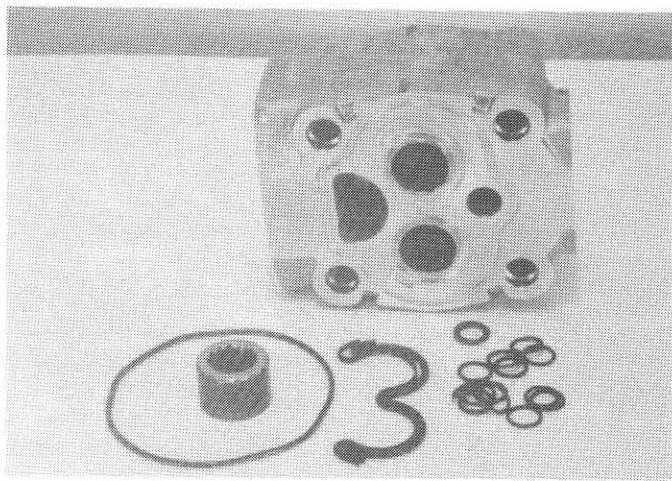


FIG. 13

16. Remove pressure plate (13) and o-ring (12) from the journal bores in the pressure plate.

17. Grasp the idler and drive gear shafts (15) and (14) and lift them out of the gear plate. (Fig. 14)

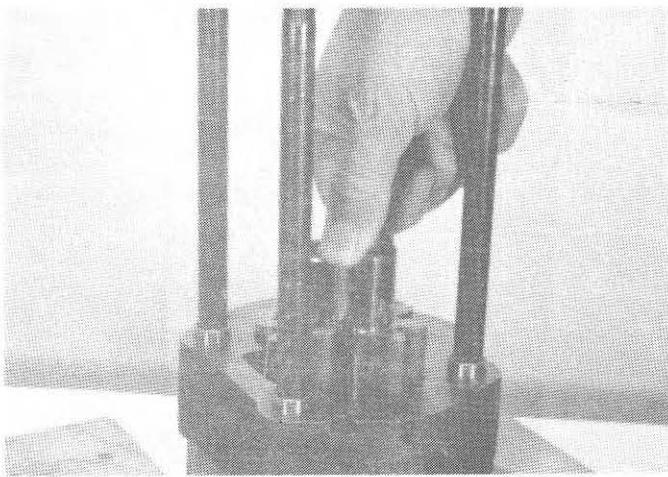


FIG. 14

18. Tap the edges of the gear plate (2) with a plastic hammer to separate it from flange plate (1). An alternate method is to lift both plates slightly off the work surface and tap the ears of the flange plate lightly. (Fig. 15)

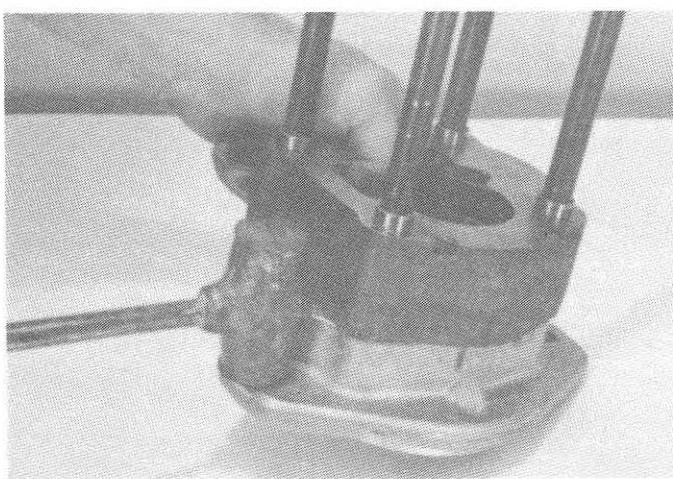


FIG. 15

19. Dowels (11) are pressed into gear plates. There are eight dowels in each plate, four on each side, and unless gear plate (2) is replaced, it is not necessary to remove them. To remove the dowels, use a punch and hammer to drive them out. Place the punch inside of dowel and against end of dowel on opposite side and tap it out. (Fig. 16)

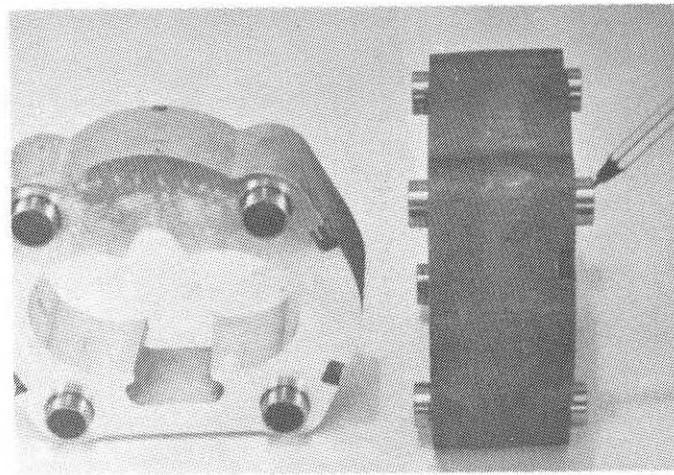


FIG. 16

20. Remove flange plate o-ring (10), pressure balance o-ring (9), and nylon back-up strip (8).
21. For shaft seal removal and replacement, see Seal Replacement section.
22. Wash all parts in clean solvent and wipe them dry with a clean shop towel or blow-dry with shop air.
23. Visually inspect all parts. For detailed instructions, see Parts Inspection section.

ASSEMBLY

24. Each TP16 pump is assembled and tested at the factory for a specific rotation. Direction of rotation cannot be reversed without replacing flange plate (1).
25. Because studs are threaded into the flange plate and o-ring stabilizers are used in the bearing plate, assembly of the pump must begin with the flange plate.
26. Obtain two pieces of wood (2 by 4) about 6" to 10" long. Lay them on the workbench parallel to each other and with the 4" dimension vertical to the bench. Position the flange plate on the blocks so that it will have steady support and the drive shaft extension will go between the blocks when the drive gear is installed. (Fig. 17)

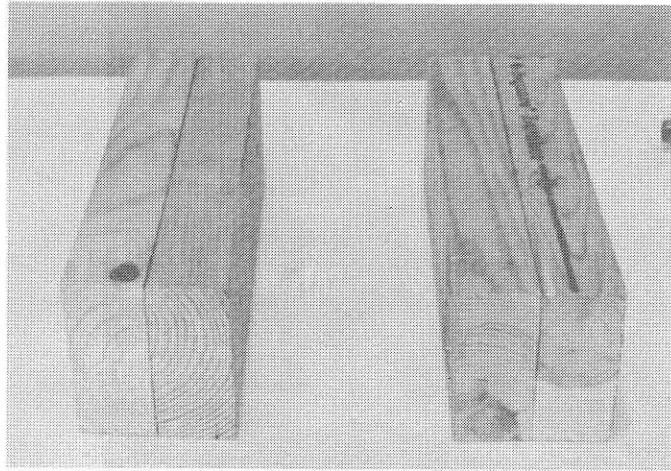


FIG. 17

27. Examine flange plate (1) and make sure shaft seal (6) and snap ring (7) have been properly installed. With the o-ring groove facing up and the matching mark you made in step 2 facing toward you, place the flange on the blocks with the seal centered between them. (Fig. 18)

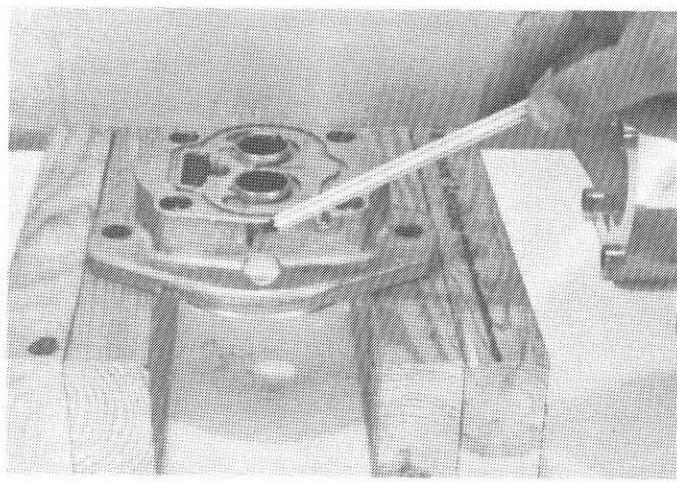


FIG. 18

28. Install nylon back-up strip (8), pressure balance o-ring (9), and flange o-ring (10). A very thin coat of clean heavy grease may be applied to the o-rings to hold them in the grooves. (Fig. 19)

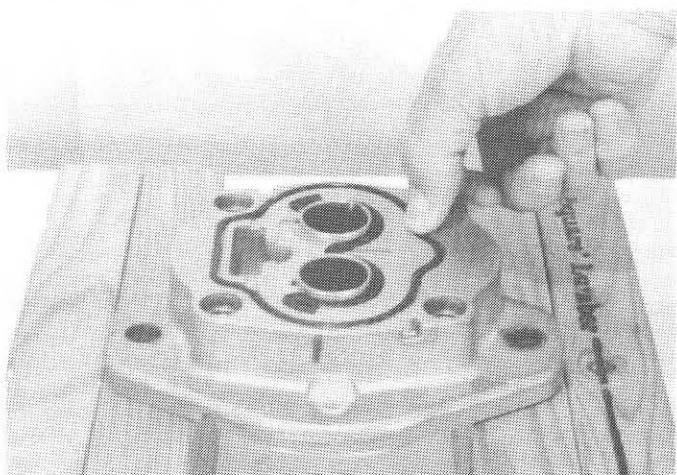


FIG. 19

29. If for any reason gear plate (2) has to be replaced, dowels (11) must be installed in both sides of the gear plate before assembling it to the flange plate. The dowels can be tapped in with a hammer, but it is best to use a dowel guide and press. Whichever method is used, make sure the dowels are started straight in the bores. If the press is used, do not apply a heavy, rapid force to the dowels. If a hammer is used, do not drive the dowels in aggressively. Tap them lightly until they bottom against the shoulder. (Fig. 20)

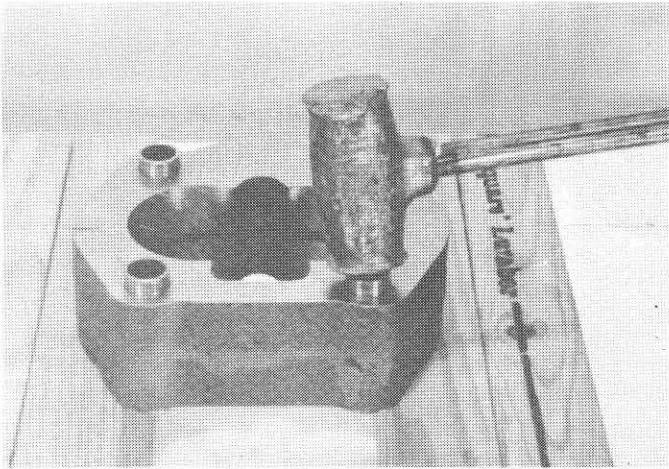


FIG. 20

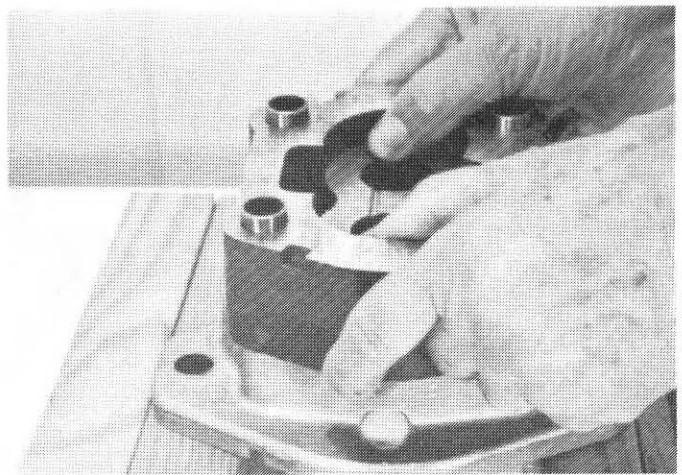


FIG. 22

30. Turn the gear plate so that the cast recesses in its outer edge faces up and align its matching mark (step 2) with the mark on the flange plate. Match dowels with bores in the flange plate. Tap the gear plate lightly with the plastic hammer until it rests on the o-ring in the flange plate. (Fig. 21)

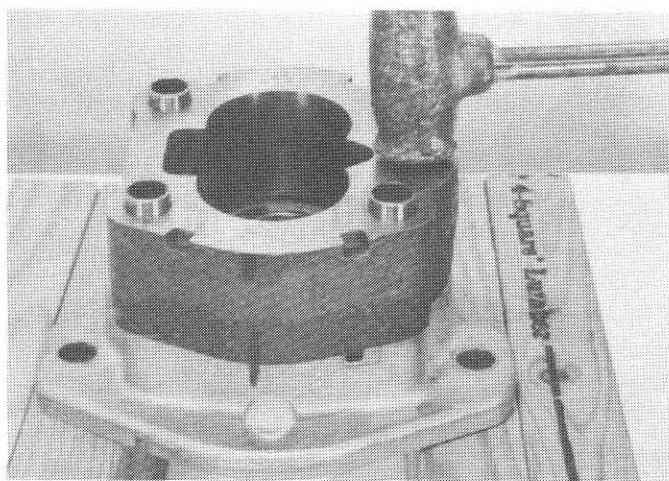


FIG. 21

31. Install o-rings (12) in the pressure plate (13). With the trap (small oblong hole) in the pressure plate facing toward the discharge side of the gear plate, and the bronze side facing up, slide the pressure plate down the gear bores until it rests against the o-ring and back-up ring. (Fig. 22)

32. Check the extension end of the drive gear shaft (14) for burrs and sharp edges. If present, remove them with medium grit sandpaper. After sandpaper has been used, clean the part thoroughly.
33. If the extension end of the drive gear shaft is splined, coat the splines with clean heavy grease. This will help protect the seal as the shaft slides through it. If the shaft has a keyway, cover the keyway with transparent tape. (Fig. 23)

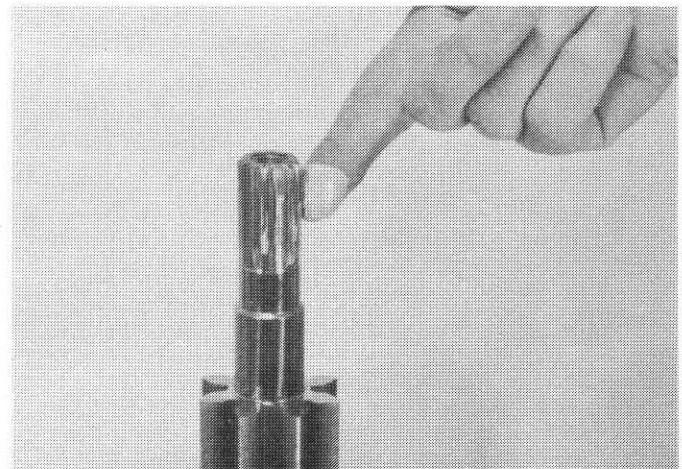


FIG. 23

34. Install drive gear (14) in the gear bore nearest to the matching mark. Install the idler gear (15) in the opposite bore. (Fig. 24)

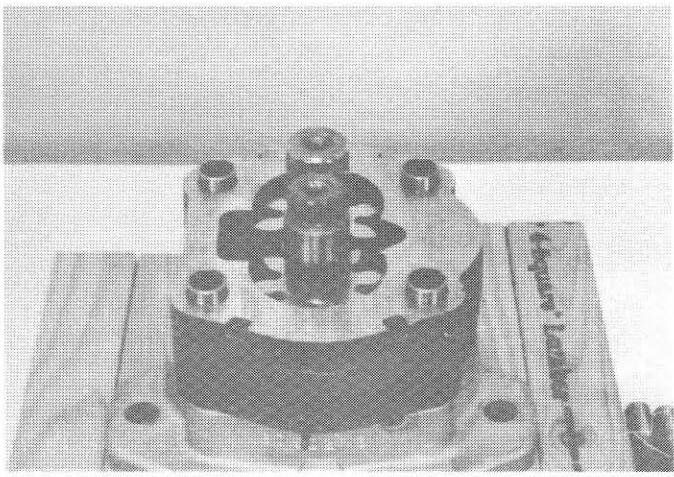


FIG. 24

35. Install o-rings (12) in pressure plate (13). With the trap in the pressure plate facing toward the discharge side, place the bronze side of the plate down against the gear faces. (Fig. 25)

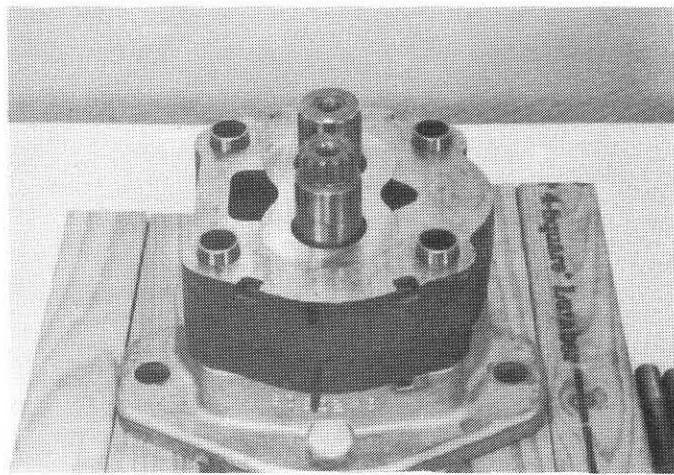


FIG. 25

36. Screw studs (20) into the flange plate at this point.

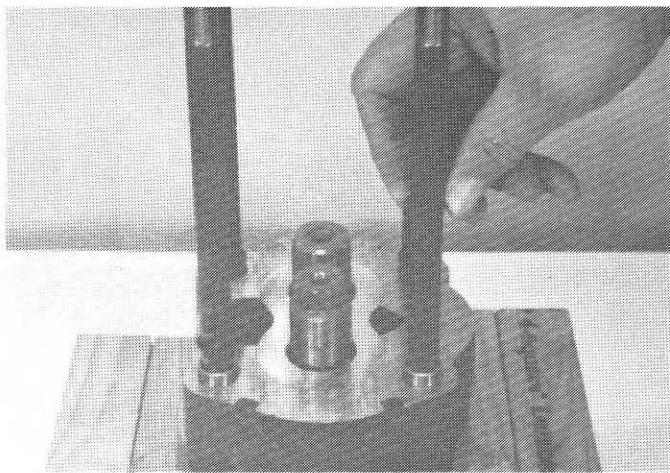


FIG. 26

37. Examine bearing plate (3) carefully. One side has a cast hole extending only part way through which connects with an external discharge port. The plate must be installed with this side facing front gear plate (2). (Fig. 27)

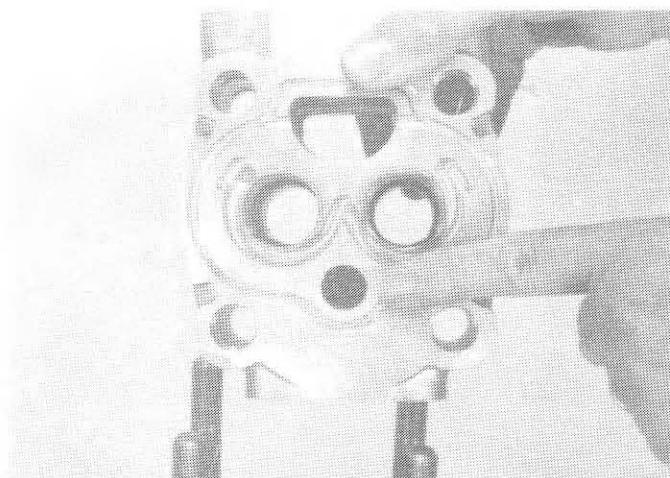


FIG. 27

38. After you have properly identified the side of the bearing plate described in step 37, lay the plate on the workbench with that side up. Install bearing plate o-ring (10), pressure balance o-ring (9), and back-up strip (8). Use clean heavy grease to hold the parts in position. (Fig. 28)

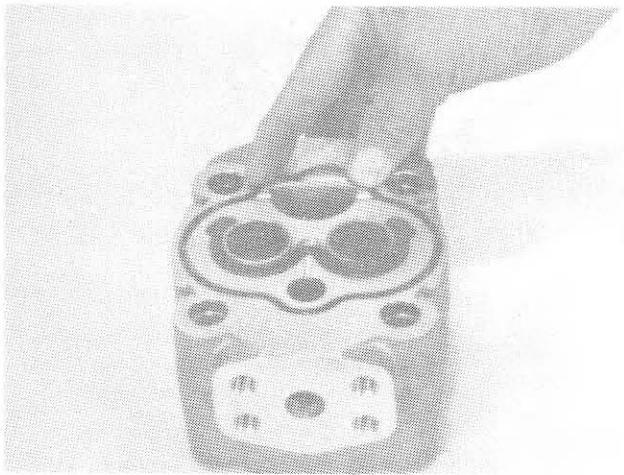


FIG. 28

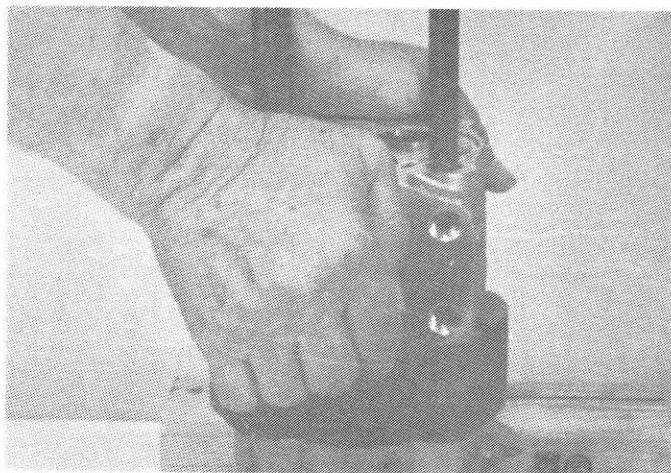


FIG. 30

39. Lift the plate and turn it over so the o-rings just installed now face down. Align the matching marks on bearing plate (3) and gear plate (2) and slide the bearing plate down the shafts until it contacts the dowels. Place coupling (17) in the suction port and line it up with the splines on the drive gear shaft. If the shaft extends too far into the suction port to allow the coupling to match up with the spline, lift the bearing plate slightly. This will allow the coupling to slide over the end of the shaft. (Fig. 29)

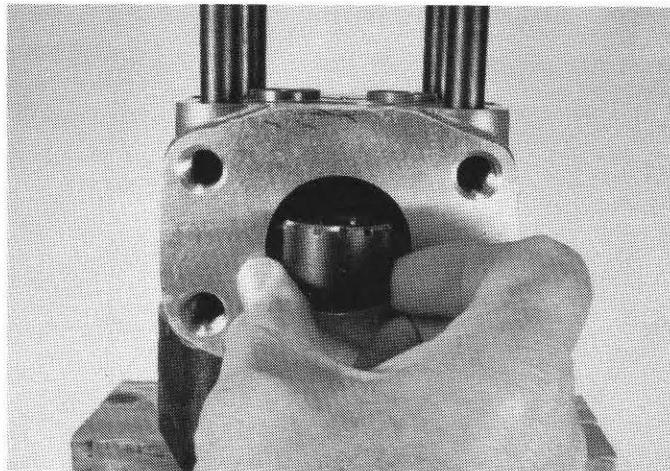


FIG. 29

41. Place a stabilizer o-ring (16) in each dowel bore in the bearing plate. Install bearing plate o-ring (10), pressure balance o-ring (9), and nylon back-up strip (8). (Fig. 31)

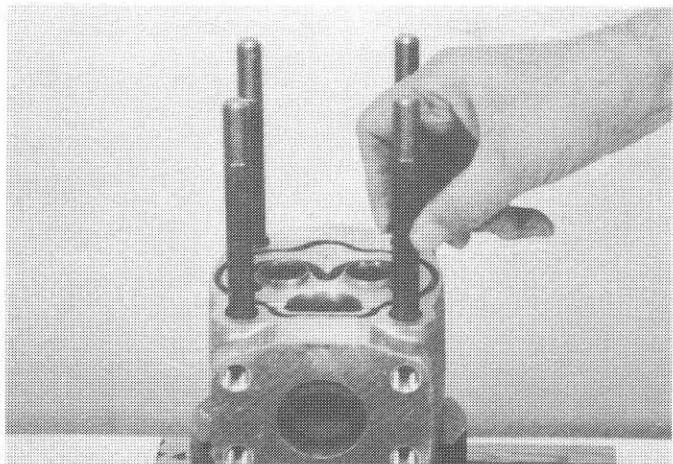


FIG. 31

40. After the coupling has been installed, check to make sure that the o-rings and back-up strip have not slipped out of their grooves. With the bearing plate contacting the dowels, use hand pressure to push it down until the o-ring is firmly against the gear plate. (Fig. 30)

42. Continue assembly of the pump following steps 29, 30, 31, 34 and 35. Make sure the rear drive gear spline is engaged with the coupling.

43. Install cover plate o-ring (10), pressure balance o-ring (9), and nylon back-up strip (8) in cover plate (5). Apply a light coat of clean heavy grease to hold the o-rings in their grooves. Use hand pressure to push the cover plate down on the dowels until the o-ring makes contact with the gear plate. (Fig. 32)

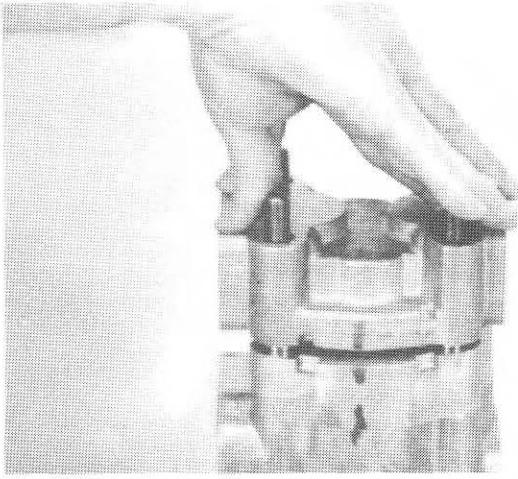


FIG. 32

44. Coat the stud threads with a light coat of oil. Install washers (21) and nuts (22). Torque the nuts to 70 to 75 lb. ft., using a diagonally opposite sequence of tightening. (Figure 33)

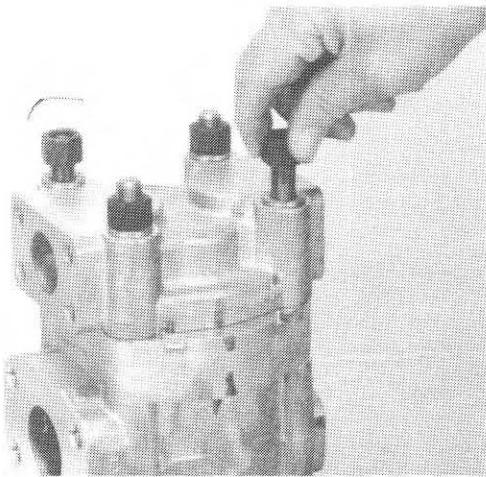


FIG. 33

45. Use a 12" adjustable wrench and see if the shaft turns properly. It will have resistance but should turn with a maximum torque of 25 lb. ft. applied. (Fig. 34)

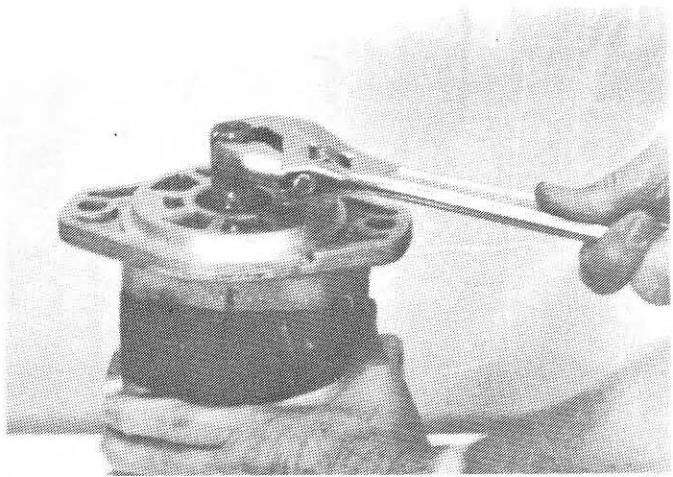


FIG. 34

46. If your pump has mounting adapter (23), install the adapter. If it has a flange adapter also, make sure it is installed first and its capscrew holes are aligned with the flange plate holes. Torque the capscrews to 35 lb. ft.

SHAFT SEAL REPLACEMENT INSTRUCTIONS
FOR P16 SERIES

1. Remove pump from the machine on which it is installed. Plug all inlet and outlet ports and wash the pump thoroughly. If shop air is available blow all contaminants from the shaft seal area.
2. If only a shaft seal replacement is to be made, it is not necessary to completely dis-assemble the pump. Of the following procedures, use those that are applicable to your pump configuration.
3. For adapter equipped models, loosen and remove capscrews and washers. Tap the mounting adapter loose with a soft hammer and slide it off the shaft. Remove the flange adapter also, if one is used.
4. This next step applies to removal of the one-piece flange plate as well as to the flange plate used with mounting adapters. Loosen and remove the nuts and washers from the four studs. Loosen the studs from the flange plate, but leave them in place in the pump. It may be necessary to tap the studs while pulling on the flange plate to slide it up the shaft far enough to insert vise-grip pliers between the flange plate and the gear plate in order to grasp and turn the studs. Use care and don't mar the finished surfaces if you have to resort to this procedure. (Fig. 1)

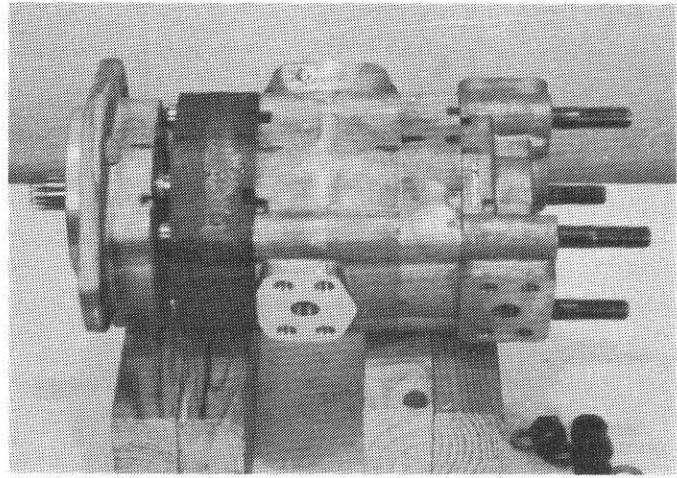


FIG. 1.

5. After the flange plate has been freed from the studs, slide it off the shafts and carefully remove and lay aside the plate o-ring, pressure balance o-ring, and the nylon back-up strip. Also remove the seal snap ring if one is used. Protect the internal pieces from contamination. (Fig. 2)

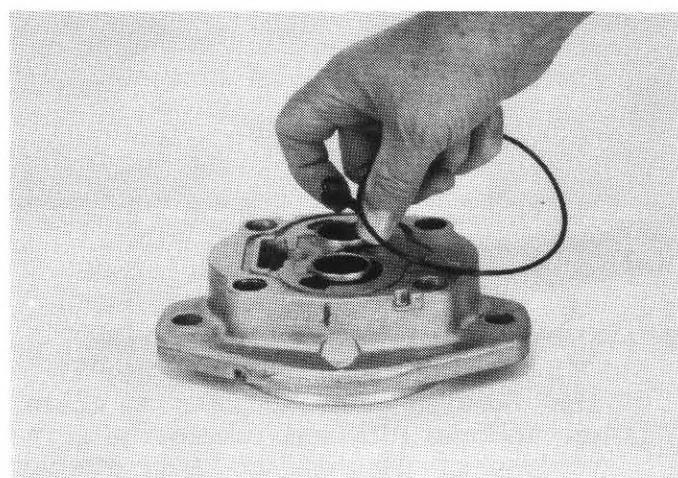


FIG. 2

6. Place flange in machinist vise. Use cardboard between jaws of vise and flange. (Fig. 3)

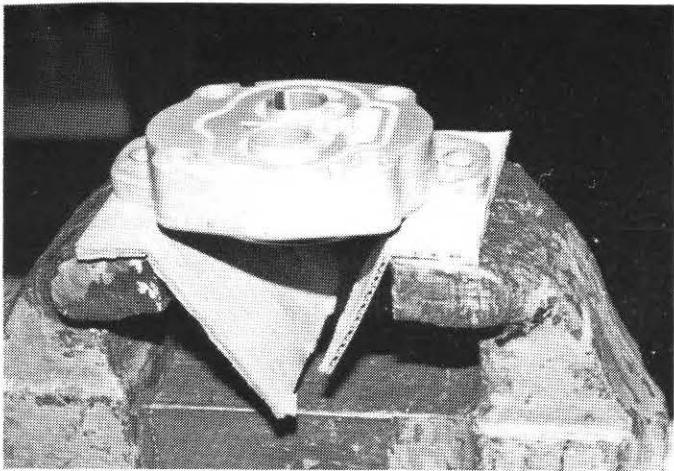


FIG. 3

7. Slide a punch of appropriate size through the bearing and against the seal's metal casing. Hold the punch away from the bearing and drive the seal out without damaging the seal bore. Move the punch around the seal as it is driven out. Do not allow the punch to rest against the seal bore or bearing while driving the seal out. (Fig. 4)

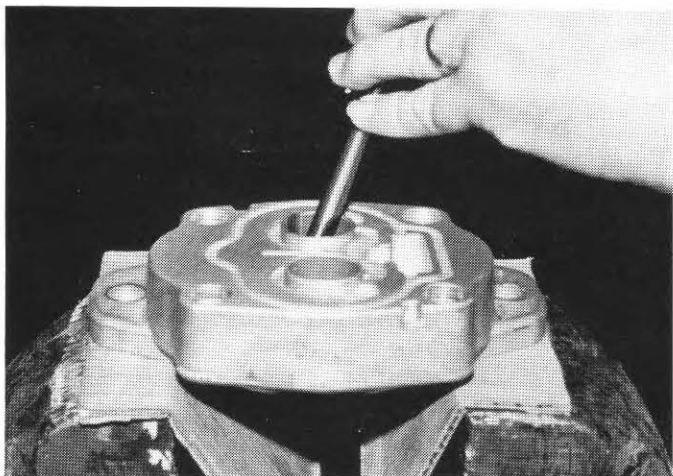


FIG. 4

8. Check the seal bore for scratches. If scratches are apparent, use a four hundred grit sandpaper to clean up the bore. Do not use coarse grit sandpaper. It will cut heavy grooves in the bore and will allow the seal to leak around its o.d.
9. Wash the flange in clean solvent and wipe it dry with a clean shop towel or blow-dry with shop air.

10. If an arbor press is available, use it to press the new seal into the flange bore. If the press is not available, place the flange in a vise with the seal bore facing the movable jaw. Arrange blocks of wood on each side of the protruding ends of the bearings, at the side next to the fixed jaw, to prevent pressing on the bearings while the seal is being pressed in. (Fig. 5)

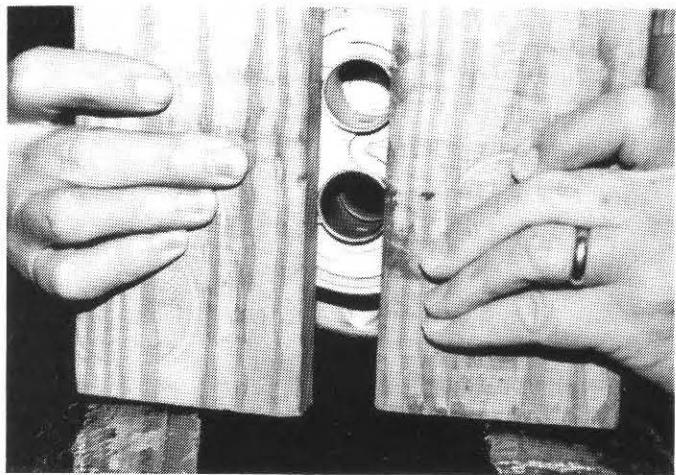


FIG. 5

11. Center the seal over the seal bore with the bottom of its metal casing facing out. Place a clean block of wood between the vise jaw and the seal. Tighten the vise slowly until the block rests against the flange plate. Make sure the seal moves straight into the bore. (Fig. 6)

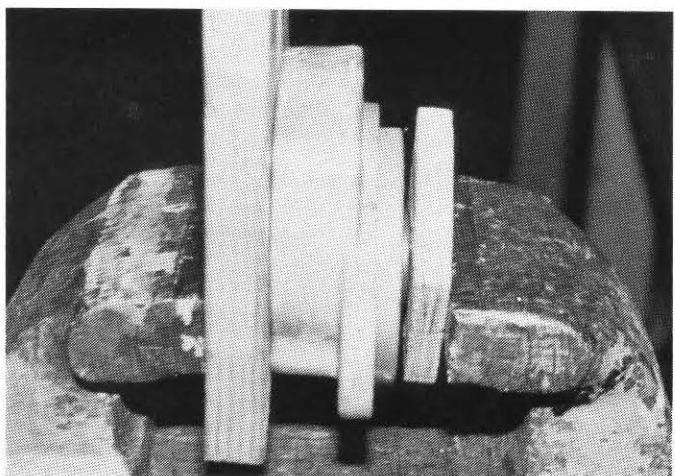


FIG. 6

12. Loosen the vise and place a socket wrench having an o.d. slightly smaller than the seal bore against the seal. Tighten the vise and press the seal in until it clears the groove in the bore. Apply two or three drops of #290 loctite at the outer diameter of the seal. Rotate the flange in such a manner that the loctite runs around the o.d. of the seal where it makes contact with the bore. Install the snap ring and wipe excess loctite out of the seal bore. Also remove any that may have gotten on the seal lip. (Fig. 7)

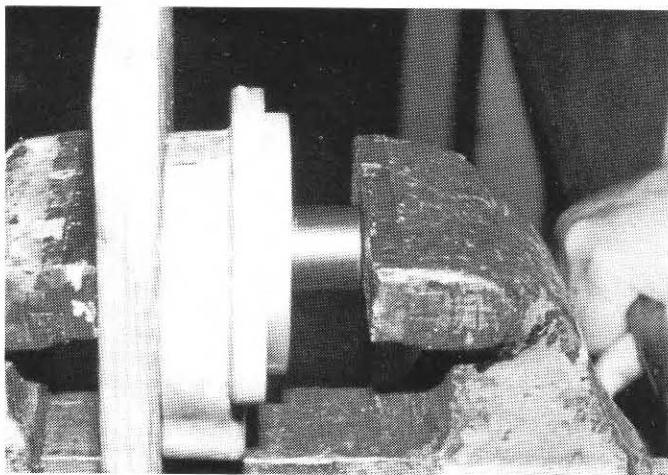


FIG. 7

13. Installation of the flange on the pump can now be done. Provide for proper protection of the seal lip as outlined in steps 32 and 33 of these instructions. Replace the plate o-ring, pressure balance o-ring and the back-up strip in the flange plate.
14. Slide the flange plate carefully down the shafts until it rests against the gear plate. Make sure o-rings remain in place. Engage the stud threads and run the studs into the plate. Install washers and nuts. Tighten stud nuts to 70 to 75 lb. ft. of torque.
15. If your pump uses the adapter arrangement flange mount, reinstall the adapters, capscrews, and washers. Torque the capscrews to 35 lb. ft.

INSPECTION OF PARTS

1. Visually inspect all parts. It is not necessary to set up gauges to check the amount of wear on the pump parts. After a visual inspection those parts which are in questionable condition should be replaced with new ones.
2. Note the bores in the gear plate. On the discharge side you will see a milled groove in the center of the plate. During the initial break-in at the factory, the gears cut into the suction side. Nominal depth of this cut is .008" and should not exceed .015". Small bits of metal are sometimes pulled out of the surface during break-in. This is not detrimental. If the cut is deeper than .015" or the plate is cracked or damaged in some other way, it should be rejected.
3. Examine the gears. If excessive wear is visible on the journals, sides, or faces of the gears, or at the point where the drive gear shaft rotates in the lip seal, reject them. If splines or keyways are excessively worn, replace the drive gear.
4. Examine the pressure plates. They should not show excessive wear on the bronze side. If deep curved wear marks are visible, replace the plate with new ones.
5. Shaft seals should be replaced. All o-ring seals and back-up rings or strips should be replaced with new.
6. Bearing i.d.'s should have a gray coating. If bronze can be seen shining through the teflon on the suction side, the bearings and plate they are in, should be replaced.

TROUBLESHOOTING GUIDE FOR GEAR TYPE HYDRAULIC PUMPS

IDENTIFICATION		CAUSE	CORRECTIVE CHECKS
1. Sandblasted band around pressure plate bores 2. Angle groove on face of pressure plate 3. Lube groove enlarged and edges rounded 4. Dull area on shaft at root of tooth 5. Dull finish on shaft in bearing area 6. Sandblasted gear bore in housing		I. Abrasive wear caused by fine particles. 1. Dirt (fine contaminants, not visible to the eye)	1. Was clean oil used? 2. Was filter element change period correct? 3. Were correct filter elements used? 4. Cylinder rod wiper seals in good condition? 5. Cylinder rods dented or scored? 6. Was system flushed properly after previous failure?
1. Scored pressure plates 2. Scored shafts 3. Scored gear bore		II. Abrasive wear caused by metal particles 1. Metal (coarse) contaminants, visible to the eye	1. Was system flushed properly after previous failure? 2. Contaminants generated elsewhere in hydraulic system? 3. Contaminants generated by wearing pump components?
1. Any external damage to pump 2. Damage on rear of drive gear and rear pressure plate only		III. Incorrect Installation	1. Did shaft bottom in mating part? 2. Any interference between pump and machine?
1. Eroded pump housing 2. Eroded pressure plates		IV. Aeration – Cavitation 1. Restricted oil flow to pump inlet 2. Aerated oil	1. Tank oil level correct? 2. Oil viscosity as recommended? 3. Restriction in pump inlet line? 4. Air leak in pump inlet line? 5. Loose hose or tube connection near or above oil level in tank? 6. Excessive operation of relief valve?
1. Heavy wear on pressure plate 2. Heavy wear on end of gear		V. Lack of Oil	1. Was oil level correct? 2. Any leaks in piping inside tank? 3. Any oil returning above oil level?
1. Housing scored heavily 2. Inlet peened and battered 3. Foreign object caught in gear teeth		VI. Damage caused by metal object	1. Metal object left in system during initial assembly or previous repair? 2. Metal object generated by another failure in system?
1. Pressure plate black 2. O-rings and seals brittle 3. Gear and journals black		VII. Excessive Heat	1. Was a valve stuck? 2. Was relief valve too low? 3. Was oil viscosity correct? 4. Was oil level correct?
1. Broken shaft 2. Broken housing or flange		VIII. Over Pressure	1. Relief valve setting correct? 2. Did relief valve function?

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